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Documenting Architectural Practice

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Dedication

To Jim and Peggy Pierce

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Some of the material in this dissertation has been modified from previous publications; chapters 4 and 5 contain edited and expanded material from:

Pierce Meyer, Katie. "Technology in Architectural Practice: Transforming Work with Information, 1960s–1990s." *Information & Culture* 51:2 (Spring 2016), 249-266.

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Documenting Architectural Practice

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This study is a situated socio-technical examination of the culture of architecture, wherein the decisions and negotiations of actors in everyday practice effect artifact creation, management, and preservation. My argument is that all participants in architectural practice are making archival decisions when they actively select what to make, what to discard, and what to keep. As a historical narrative, the study addresses continuity of architectural documentation by examining how everyday practices, and the resulting artifacts, have changed over time. Working from a critical constructivist framework and employing an interpretivist methodology, I adopted mixed methods to provide a rich understanding of the history of architectural and archival practices in which to situate my analysis and address the following question:

> *How might architectural artifacts be preserved in ways that illuminate the complexity of practice and the multiple layers of assumptions and values that inform the co-construction of the built environment?*

The story I want to tell about architecture requires investigation through three methods, each addressing one of the primary concerns of my research. The historical examination of

computer technologies for architecture situates my understanding of the artifacts of practice within the context of debate about the value of specific tools for architecture and discussions about role of the architect within the industry. A reflective analysis of learning architectural technology describes my work to understand two specific tools used in architecture, AutoCAD and Revit.

I introduce how complexity and uncertainty are woven throughout architectural practice, problematize the attribution of architecture to solo creators, and establish a framework for how to study complex workplaces, in particularly situated action in an architectural firm. Employing Howard Davis' concept of "building culture" as a frame for considering the larger context within which people do architectural work, I describe historical cases of technological change and how information (as concept) is used in doing architecture. I examine an in-depth case study that provides an enhanced understanding of what contemporary architectural practice looks like and how artifacts are an integral part of the doing of architecture. Drawing on results of my research, I develop an "architectural information system" concept and address building social and technical infrastructure to document and preserve architectural artifacts.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

RESEARCH OVERVIEW

> "A crucial link in the continuum between architectural records of the past and those of the future is being contemporaneously lost simply because no one knows what to do with the records of the moment" – Laura Tatum (2002)

A story of contemporary architecture is one of making things – making places, making buildings, making drawings, making models, making decisions. It is a messy story with many actors, only some of whom are architects. Architecture is a social practice that extends beyond the walls of any firm, to collaborators within the field, to clients with particular expectations, to government officials and industry organizations making decisions about building codes, to digital tool designers aiding in design and construction processes, to the artifacts created through the application of those tools. Each of these actors plays a role in the history of architecture and the construction of the built environment. Preserved artifacts of architectural practice can tell stories about what has been designed and built, about negotiations and decision-making in practice, and about the many people working to construct the built environment. How do artifacts tell us these stories? Which ones best illustrate the making of things in architectural practice?

Actors socially construct the value of architectural artifacts by actively selecting which artifacts become records – which to create, share, and keep in the everyday practice of architecture, in the recordkeeping practices at a firm, and in the process of transferring records to a repository. These decisions are made in the preservation of records, but also in

the continual making of architecture. We need to understand the doings – the performative activities of architectural practice – in order to preserve the makings. Specifically, this research addresses the following question:

> *How might architectural artifacts be preserved in ways that illuminate the complexity of practice and the multiple layers of assumptions and values that inform the co-construction of the built environment?*

One focus of my study is on the artifacts other than buildings that are created through the everyday activities of an architectural firm – drawings, models, specifications, contracts, spreadsheets, writings, membership documentation, sketches, and notes, to name a few. These are the material culture of practice, the makings of architecture. Architects construct knowledge and communicate their expertise through such artifacts, which can tell stories about the architect's vision; the design iterations of the development team; working relationships among architects, clients and collaborators; and decisions made throughout the process of design and building. These artifacts are not yet records; it has not yet been determined that they have enduring value. But judgments take place every day about what to keep from the negotiations of architectural practice. Making informed decisions about which artifacts to preserve requires understanding how they are made and what their roles are in the doing of architecture. I am operating from the position that architectural records are valuable sources of information that document the built (and unbuilt) environment and the social history of the communities in which they are created.

A second focus of my study is on people and their actions. From a socio-technical perspective, the focus on action is a means of understanding how the artifacts of practice are made and to understand the value of architectural artifacts. Decisions about what

technologies are used, what artifacts are made, and which artifacts to keep all depend on what has value and these decisions all have implications for how we continue to build. Architectural scholar Howard Davis defines building culture as "the coordinated system of knowledge, rules, procedures, and habits that surrounds the building process in a given place and time" (Davis 1999, 5). In this dissertation, I document how artifacts have roles in "building culture," in the design and construction of thousands of buildings "produced through shared processes held together by shared knowledge" (Davis 1999, 5). Within "building culture" I argue that there is an architectural information system, a socio-technical network upon which we can build the infrastructure to preserve artifacts. I chose a narrative structure to tell this story to articulate how I approached my research and particularly how my study evolved over time in response to what I learned. The narrative approach also illuminates my own individual understanding and decision making within the context of interactions with other peole and artifacts. My research is an effort to begin to account for the architectural information system and to populate what we know about architecture through an extended case study. But first let's return to a consideration of value.

VALUE OF ARCHITECTURAL ARTIFACTS

There are many reasons to carefully consider both which architectural artifacts to preserve and how these decisions are made. Multiple overlapping communities of practice, including architects, archivists, historians, educators, and property owners and users, mutually construct the value of architectural artifacts. Many types of materials produced

by architectural firms – from design sketches to working drawings to as-built photographs – can serve different purposes for these groups of people.

Artifacts can be useful for practical purposes – providing information, serving as evidence, and documenting how buildings are made. Participants in building culture use architectural artifacts as sources of inspiration, documents that contain evidence for historic preservation, restoration, and reconstruction, and as useful examples in the education of future practitioners (Lowell and Nelb 2006). As part of the material production of architectural practice, artifacts function as agents of communication, as documentation of design decisions, and as evidence of the collaboration and negotiation among architects, engineers, designers, and clients over the course of a project (Altürk 2008). Artifacts also provide information about decisions made by a firm and its clients during a project, serve as demonstrations of contractual agreements, and can provide protection from potential litigation (Victor O. Schinnerer & Co. Inc 2003; Simpson and Adkins 2005; Langmead 2007; Shu 2008; Ball 2013).

Extending beyond the immediate practical functions of architectural artifacts, these records also tell stories about cultural history, values, and conflicts. Historians and other scholars value architectural artifacts as historical sources of information about the design process, architectural intentions and legacy, firm culture, national heritage, and, sometimes, documentation of the people behind the construction of the built environment (Thomas 1996; Lowell 2006; Wiser 2006; Langmead 2007). Drawings, models, and project records can provide information about temporary structures or buildings that have been destroyed (Franken, Scharrer, and Wolf 2008). Architectural documentation of unbuilt

projects has scholarly value to those who want to contest a dominant historical narrative or simply understand more fully the negotiations through which the built environment is constructed (Oberdeck 2006). Additionally, some scholars, architects, and cultural journalists have described the aesthetic value of architectural artifacts, as artistic objects, which can lead to additional financial gain for creators or records keepers if artifacts of their practice become valuable commodities (Cuff 1992; Pogrebin 2007; Pogrebin 2010; Syrkett and Stephens 2010; Desaulniers 2010).

I approach architectural practice, and therefore the production of architectural knowledge and artifacts, as an example of situated action. Lucy Suchman, in the conceptual development of situated action, embraces the complexity of actors and artifacts in relation in specific localized contexts. To interpret action, one must acknowledge that the action is situated in particular social and material circumstances (Suchman 2007). Artifacts can serve as evidence of the socio-technical context in which they are created. The artifacts produced in everyday architectural practice are social objects created to serve various purposes within the culture of building, but they are also cultural artifacts that can tell us something about the environments in which they were created. As the physical instantiations of the doing of architecture, artifacts are evidence of knowledge production. These artifacts, and especially collections of these artifacts, can illuminate the architectural process of making things that include artifacts, but also decisions, places, and relationships, to name a few.

CONTINUITY OF ARCHITECTURAL DOCUMENTATION

So, what do we keep? As an archivist and architectural historian, I initially approached the research topic out of concern for the continuity of architectural documentation. Changes in the way architects work, specifically the increased use of computer technology in everyday practice, complicate the long-term preservation of the artifacts in archival repositories. Architectural firms have been using computers as an integral part of everyday practice since the 1970s (Tatum 2002; Fallon 2004). With the shift to digital design and asset management within contemporary architectural practice, libraries, archives, and museums face new challenges in the acquisition, appraisal, and preservation of records (Peyceré 2008). Long-term preservation of records is not generally a high priority in the deadline- driven contemporary architectural environment, but preserving artifacts has been a high priority for information repositories that function as stewards of architectural materials.

In 2002, Laura Tatum addressed the problem of archiving digital architectural records and called for archivists to become actively involved in the long-term preservation of design records by working with architects during the design process. She stated her concern that "a crucial link in the continuum between architectural records of the past and those of the future is being contemporaneously lost simply because no one knows what to do with the records of the moment" (29). Her words are a fitting epigraph to my dissertation, which focuses on understanding what architects currently do and addresses how we got here, in terms of some key decisions in digital design development.

Scholarship by members of the libraries, archives, and museums community has addressed problems associated with continuing to collect, preserve, and provide access to architectural records (Fallon 2004; de Grassi et al 2008; Peyceré 2008; Smith 2009). Firms produce and manage a variety of digital records – drawings, photographs, specifications, and correspondence – many of which are created using proprietary software. In addition to the digital files so generated, many firms still print and make changes on paper drawings and retain legally required documentation. Preserving artifacts to document architectural practice requires understanding digital record creation as well as the paper production of a firm (Picon 2008; Peyceré 2009).

The first major project that attempted to study born-digital architectural records in the United States was conducted by the Department of Architecture at the Art Institute of Chicago beginning in 2003. The purpose of the study was to understand how architecture and design firms create and use digital data in order to determine best practices for archiving this data within archives and museums. The investigators conducted a two-part examination to determine the current digital data practices of architecture firms. In-depth case studies of projects from nine firms in the United States provided information on the use of digital tools as part of the design process. Investigators also conducted an international survey that gathered data about digital tools and methods from over one hundred design firms. Additionally, they evaluated archival projects and methodologies that dealt with the long-term preservation of rapidly changing digital data formats. Investigators found that no museum or archival program had successfully solved the

preservation difficulties faced by information professionals in repositories of architectural records (Fallon 2004).

In 2007, the Massachusetts Institute of Technology (MIT) Libraries' Digital Libraries Research Group and MIT's Department of Architecture received funding from the Institute of Museum and Library Services (IMLS) to investigate ways of creating a structure for preserving digital CAD files and the use of open source solutions to store and provide access to architectural records. The FACADE (Future-proofing Architectural Computer-Aided Design) project investigated strategies for curating and preserving these difficult files, and made recommendations for the identification, migration, and emulation of 3D CAD models (Smith 2009). Both of these projects produced data on contemporary architectural practice, recommendations for preserving complex digital design records, and prototype programs that could be used to archive records. But engagement in discussions in the archival community indicated that the infrastructure and expertise to deploy these solutions is often lacking and there is a need to build a shared infrastructure (Harvard 2016).

The Architectural Records Roundtable of the Society of American Archivists created the CAD/BIM Taskforce in 2012. These groups have developed an active community of practice and provide networks for communicating about digital design preservation. As a member of this community, I am an engaged architectural archivist/librarian concerned with long-term preservation of architectural documentation and how digital technologies are changing archival practices of collecting architectural records. A member of the Architectural Records Roundtable, I recently presented my dissertation research at the Society of American Archivists 2017 Research Forum and will

participate in two upcoming community building fora on digital assets and the built environment. Hosted by the Library of Congress, the National Gallery of Art and the Architect of the Capitol, "Designing the Future Landscape: Digital Architecture, Design and Engineering Assets," will focus on case studies and thematic discussions about digital records. As a member of the program committee and a presenter, I am contributing my expertise as an archivist and historian, as well as a socio-technical perspective to discussions about how, when, why, and for whom we preserve digital artifacts. "Building for Tomorrow: Collaborative Development of Sustainable Infrastructure for Architectural and Design Documentation" is an IMLS-funded forum on digital design preservation to be held prior to the annual Society of Architectural Historians conference. I will contribute my research and findings to suggest that the infrastructure for archiving digital documentation build upon and critically examine what I will describe as an existing "architectural information system." My research both benefits from my engagement with this community and contributes to the continuing conversations, particularly as we continue to collectively construct socio-technical infrastructure to document architectural practice.

I want to assert that we can view this moment as an opportunity to rethink what we do with records, how we make appraisal decisions, and who is involved in the decision-making. In seeking to document contemporary architectural practice, instead of asking how we can preserve digital versions of the records archives typically collect, we should be asking which artifacts have value in the first place and why. We should ask how we can not only preserve artifacts, but how to make relationships between artifacts intelligible, and

how to make the processes of building culture visible. In this study, I focus on the socio-technical production of material artifacts, considering the history of architectural technology and the everyday actions through which artifacts are made. The study addresses continuity of architectural documentation by examining how everyday practices, and the resulting artifacts, have changed over time.

AUDIENCE AND THE ARCHIVAL CHALLENGE

A story about contemporary archival practice is also about making things. Archivists make decisions, finding aids, databases. Archivists make meaning in the mess or at least provide a means of making the mess intelligible. The scope of my study is architectural practice in the United States, from the 1960s to the present. Specifically, the study aims to contribute to the literature on the continuity of architectural archives, that is the continuation of collecting practices that allow artifacts of architectural practice to be kept and made accessible over time. My primary audience is archivists, particularly those who are concerned with collecting both paper-based and born-digital records. My intervention involves bringing my knowledge about archival practice, architectural history, and workplace studies to ask questions about what records we should be collecting and how we can do so in a mindful, deliberate way. Such work demands actively entering and engaging an architectural firm – at a point before records become records. I use the term "artifacts" to extend the body of potential archival records beyond those that are typically collected in architectural archives and to connect to the work practice literature. My use of the term "artifacts" stems from a desire to approach appraisal by addressing the activities,

the actors, and the processes in architectural practices before considering the record-ness of the resulting artifacts and then determinations of value. But I also argue that determinations are always happening in practice, in the construction of artifacts – by many others outside the archives. Architects describe artifacts as evidence to be used in their practice, but does this mean the artifact has enduring value and should be preserved? How and when are these decisions made, and how can these value articulations be addressed in the appraisal?

The preservation of records documenting architectural practice will involve both understanding digital records and making connections to the paper production of a firm. Tawny Ryan Nelb (1996) identifies five challenges in appraisal practices for architectural archives:

- Project records are widely scattered across the many departments and agencies;
- Architectural offices contain many duplicate records;
- The volume of records produced in architectural practice is difficult to manage;
- Records can be treated as temporary or easily discarded once documentation is no longer required by a firm; and
- The technologies used to create architectural records and the physical media on which they are stored can pose preservation issues.

The last two challenges address the use of computer technologies in the creation of architectural records, which is the focus of much discussion in architectural archives practice. My research takes a more "fundamental" tack, creating an opportunity to engage

appraisal issues from within architectural practice by asking questions about what records are worth creating, worth keeping, and why.

Of course, not all firms have dedicated records managers, in the sense that they are trained as such or ascribe to professional standards for records management. Some firms have trained archivists on staff, but there are various ways that archivists approach records in practice. At the same time, I think everyone is a records manager/archivist of their own material and that we are all always in the process of appraising our records. Appraisal decisions are made every day in architectural practice, but the criteria for evaluating the value of records can differ depending on the situated context for decision-making. Part of the goal of my research is to identify the various actors who make keeping decisions and create a preliminary network of associations between their practices. As I will discuss further in the discussion and future research sections, I assert that increased interaction between archivists and architects is needed to make deliberate meaningful decisions about how to best document architectural practice.

While my primary audience is archivists, a further important consideration is what the study aims to tell historians of architecture and sociologists of architecture that they do not already know. I tell historians about artifacts of practice that can help tell stories about building culture – perhaps different stories, or new ways of approaching the history of the built environment. For sociologists of architecture, I bring the history of technology into conversation with the everyday work in a firm and articulate what artifacts do in practice. I want to tell these various communities what we may lose if we do not actively engage in thinking about what to keep beyond the necessary but not sufficient question of which

digital artifacts designated as records to place in archives. To all audiences, I want to acknowledge that we can tell stories about architecture only because we have artifacts of practice that help us to do so. To decide which drawing to keep or whether it is worth paying for extra storage space or to hire someone to manage and migrate data – these all have implications for the stories we can tell.

APPROACHING THE PROPOSED RESEARCH FROM A SITUATED PILOT STUDY

A pilot ethnographic study I conducted in an architectural firm, "Documenting Architectural Practice: An Introductory Investigation of Digital Project Records (DAP)" illustrated key themes in architectural practice and has been useful for developing the full study reported here. In the pilot, I observed and interviewed five individuals over a period of three months. My initial intent was to explore what records were created in an architectural practice, which digital technologies were used, and what hardware, software, and workflows are needed to preserve architectural records. Through the interviews, observations, and concurrent reading about work practices, my focus changed to a more fundamental concern: trying to understand who creates artifacts in architectural practice and how artifacts are created and used. In my pilot study and the literature on architecture, I confronted the complexity of practice: the collaborative nature of the work and the iterative processes in action. The initial focus on "architectural records," defined as documents created, accumulated, and preserved in the process of constructing and documenting the built environment (Pearce-Moses 2005), shifted to the artifacts of practice

to more broadly engage the makings of architecture that have not yet been preserved and therefore not yet selected as "records."

I am using the term "practice" throughout this report in two ways. "Architectural practice" includes the everyday professional activities, interactions, and knowledge that result in the artifacts of building design and development (Cuff 1992). "Practices" or "everyday practices" are recurring activities and situated actions or what people "do" in the conduct of their work (Pickering 1995; Orlikowski 2002; Suchman 2007). Practices are the everyday doings within architectural work that result in the making of artifacts, while architectural artifacts are the physical instantiations of making things in practice. They are representations, but not merely that. Additionally, artifacts can represent multiple things, and their meaning can change over time or for different groups of actors.

My pilot study involved a firm created when two architects formed a partnership at the end of the nineteenth century. When I conducted the pilot study, the firm had five locations across the United States, three of which are in Texas. Led by eight principal architects, the organization comprises architects, engineers, interior designers, community planners, and consultants, as well as administrative staff, marketing and accounting personnel, and assistants. I selected the firm based on its long history, the breadth of its architectural projects, and the availability of research participants. Three of the five pilot study participants were licensed architects, one was the graphics librarian and part of the marketing department, and the last was the facilities manager, who works in contract administration and oversees the paper and digital archives storage. In the full study, I use research data collected through the pilot study's interviews and observations to raise

questions about how we can preserve the iterative processes of architecture at work. The DAP study was a starting point for examining activities and artifacts in an effort to extend social science interpretations of architectural practice and to contribute to efforts to preserve both the makings and the doings of architecture. I examine my pilot study findings further in chapter 5.

ACTIVE AGENTS DOCUMENT ARCHITECTURAL PRACTICE (AIMS OF THE DISSERTATION)

As mentioned above, many actors in several communities of practice socially construct the value of architectural artifacts. Imagine a conference table with architects sitting on one side and archivists on the other. I had the benefit of being at such a table, on the archivist side, during a meeting about the potential transfer of records from a firm to an archives. The head archivist asked the architects which materials should be donated to best document the firm and represent its legacy. The architects responded that the archivists should make that determination. Each group was working from the assumption that the other had the expertise to make determinations about the value of architectural records. My argument is that they are both correct. These two different groups of actors have roles in actively selecting which artifacts become records. Architects make decisions about the enduring value of artifacts in the doing of architecture while archivists make value judgments in the appraisal of architectural records transferred to the archives.

My dissertation addresses the appraisal of architectural records across the records continuum, actively engaging the variety of actors who make decisions along the way about what is kept. I seek to explicate the negotiated process of deciding what to keep – to raise

questions about why individuals and groups decide to keep some artifacts and discard others, and to examine how deliberate the decision-making is in practice. The story I want to tell about architecture requires investigation through three methods, each addressing one of the primary concerns of my research:

- Historical examination of computer technologies for architecture;
- Reflective analysis of my learning architectural technology;
- In-situ investigation of people and artifacts in practice.

The overarching goal of my research is to consider how to best document architectural practice, by which I mean, how might we best retain artifacts that illuminate the complex working practices of an organization over time in a way that these records remain accessible, for the organization and for future scholars? For records to remain accessible, the technical challenges of preserving artifacts created using varying technologies will need to be addressed, but if accessible also means intellectually meaningful, we must consider the context of architectural production and decision-making. Providing long-term access to the artifacts of architectural practice means providing access to how meaning was made through and around those artifacts.

Instead of trying to preserve digital versions of records that archives typically keep, I want to examine what artifacts are made and how, to ask both archivists and architects to consider which artifacts *should* become records. Which artifacts should we keep to best document practice and tell stories about how the built environment is made or not made? Which artifacts can show what architects do, how they think, and who/what is interacting in practice? My research involves a situated socio-technical examination of the culture of

architecture, wherein actors make decisions and negotiations every day that affect artifact creation, management, and preservation. My argument is that all participants in architectural practice are making archival decisions when they actively select what to make, what to discard, and what to keep.

Through an iterative process of reading, ethnographic research inquiry, and extensive discussion with colleagues in archives, information studies, and architecture, my foundational question is informed by the sociological literature I review in subsequent sections and draws on a socio-technical framing of interplay between humans and non-humans in practice. As noted above, I seek to address this overarching question:

> *How might architectural artifacts be preserved in ways that illuminate the complexity of practice and the multiple layers of assumptions and values that inform the co- construction of the built environment?*

The particular research questions that guide my work follow from this foundation. As I examined architects in practice and reviewed literature on collaborative workplaces, I began to reframe my research to focus on the complex coordination of many people and technologies in everyday practice. I adopted a socio-technical approach to examine the interactions between humans and artifacts, drawing on actor-network theory, in the development of these questions.

- What is the role of artifacts in architectural practice?
- What are the processes that lead to artifact creation, destruction, and preservation?
- What do artifacts reveal about architecture?
- Who makes judgments about which artifacts to keep in everyday practice?

- How do artifacts figure into decision-making processes?
- Which material artifacts produced in architectural practice have enduring value for documenting the built and unbuilt environment and interpreting the culture of the communities in which they are created?

In a fundamental way, the study engages a question about history and cultural narrative: What kinds of stories can we tell about architecture? The decisions that are made in everyday practices – architectural and archival – enable the kinds of histories that can be written. The stories we can tell about architecture depend upon the everyday decisions made in practice about which artifacts have value. Which stories do we want to tell?

Throughout this dissertation, I tell stories about architecture and about what others have said about architecture as practice. Each of these stories serves a purpose of identifying ways of approaching the topic that focus on interactions between people and artifacts. Chapter 2 brings together my reading of sociology of architecture, workplace studies, and archival appraisal literature. It introduces how complexity and uncertainty are woven throughout architectural practice, and I problematize the attribution of architecture to solo creators. The chapter establishes a framework for how to study complex workplaces, particularly situated action in an architectural firm. Artifacts are identified as active agents in practice, but the chapter makes a distinction between humans and non-humans. Only humans have intentionality, and it is precisely this intentionality that is needed to make record-keeping decisions.

Chapter 3 situates me in my research study. I describe my pilot study, my reflections on what I saw in the firm in 2010, and the subsequent development of a revised

approach to studying architecture and the resulting artifacts of practice. I am building on the knowledge gained from my pilot study, and from methods in sociology of architecture and workplace studies, to construct a reflective socio-technical framework for interpreting what I read about technology development, how I describe my own interactions with artifacts in learning, and how I analyze what I see in practice.

Chapter 4 presents one story about technology development for architecture. Employing Howard Davis' concept of "building culture" as a frame for considering the larger context within which people do architectural work, I describe three cases of technological change and how information (as concept) is used in doing architecture. Chapter 4 addresses the role of artifacts in architectural practice, particularly by considering the role(s) of architects in their interactions with technologies. I also grapple with my own process of learning two architectural technologies, important both to general architectural practice and to the specific firm that was the focus of the pilot and full studies.

Chapter 5 tells a story about contemporary practice, presenting a singular case study in an architectural firm, addressing questions about what is created, what is kept, and who makes these decisions every day. The chapter functions as an intervention into the workplace, engaging architects in conversation about which artifacts have value, based on the ways architects work. I examine the interactions between people and artifacts in a situated project team's internal collaboration and the role of artifacts in coordinating work with external consultants. I identify where and how decisions are made about what to keep and what to discard.

Chapter 6 provides descriptors for practice, drawing from what I learned through three research methods. I re-engage themes described in Chapter 2 and provide examples of how these themes are evident in what I saw in everyday practice. I address how my research specifically answers particular research questions. Finally, I assert what I see as the primary archival challenges related to architectural artifacts and what I think we must do to address these challenges. In the final chapter, I conclude by discussing what we have learned and what I see as necessary actions.

To get to these stories about architectural practice and what has been learned through my research, Chapter 2 provides the frame for the remaining work and the study's fundamental orientation toward the role of artifacts and people in architecture.

Chapter 2: Actors, Artifacts, and Enduring Value

In Chapter 2, I review three literatures that inform my dissertation research. The sociology of architecture literature frames my narrative by providing multiple readings of architectural culture as complex, uncertain, and collective. Workplace literature helps orient my work and gave me the language to make meaningful observations from the everyday practices I saw in the pilot study, which contributed to the development of my research design. Finally, I review the archival appraisal literature, which situates me as an archival scholar concerned with how and when value determinations are made.

THE SOCIOLOGY OF ARCHITECTURE

What do we know about the culture of architectural practice? The sociology of architecture literature focuses on the practice of architecture as a profession as well as on architectural practices as situated objects of inquiry. Robert Gutman, Judith Blau, Dana Cuff, and Albena Yaneva contribute to the body of literature that illuminates the social roles of architects, the complexity of architectural practice, and distinctions between what architects do and perceptions of the profession. Themes that emerge from the literature include the following:

- The individual creative genius "doing" architecture is a myth.
- Architectural practice involves complex and uncertain relations among people.
- Architects communicate knowledge and expertise through negotiation.

I will examine each of these themes in turn in the following section and draw on literature that helps me consider the role of artifacts in the complex social circumstances of architectural practice.

The individual creative genius "doing" architecture is a myth

The perception of what architects *do* is at odds with what happens in the everyday situated circumstances of architectural practice. In *Architectural Practice: A Critical View* (1988), Robert Gutman clarified the context in which architects operate and documented changing professional experiences of architects. One of his intentions was to illuminate the ways in which what architects *do* is often misunderstood both within and outside the profession. Gutman sought to de-mystify the role of the architect, particularly to show that most practitioners spend very little time independently engaged in "the art of design" activities and that a wide range of other tasks are required in everyday practice (Gutman 1988 and 1997). He reports that architects' experience of the activities of practice violates common expectations of what architects do (Gutman 1997). Outside the profession, and to some extent inside the profession, the archetypal architect is a solo creator, an individual designer of buildings, whose vision is articulated through drawings and models into built form. In this view, designing is the primary activity of an architect, whereby designing means conceiving of a built work and producing the necessary documentation to communicate the vision and facilitate construction.

The myth of the individual creative genius *doing* design is perpetuated through mass media depictions of architecture, the art historical tradition of focusing on individual

creators, and even the studio culture in architectural education. Dana Cuff begins *Architecture: The Story of Practice* by acknowledging her own mistaken expectation that an architect would spend her time in a studio, relatively independently, drawing. She notes that Ayn Rand's *The Fountainhead*, a popular 1943 novel and 1949 movie, informed her idea of what architects do, but she acknowledges that her expectation does not accurately reflect the variety of activities or people involved in everyday practice (Cuff 1992). Rand's central character, Howard Roark, serves as an intense, creative, and driven individual iconic architect-hero. The image is reinforced by the mass media attention given to American architect Frank Lloyd Wright, who became a celebrity and icon of the culture of architecture. Wright's work and ideas were covered in the architectural press, but also in popular magazines, including *Time*, *Life*, *House Beautiful*, and *Home and Garden* (Alofsin 1999). Since the 1970s, a "culture of architecture," communicated through guidebooks, museum exhibitions, newspaper critiques, and public television programs, has raised some individual architects to celebrity status (Gutman 1988).

Additionally, architectural historians and critics construct and perpetuate the myth of individual designers and buildings in the creation of the canon. Continuing an art-historical tradition based on nineteenth-century German scholarship, most architectural history has valued only a small portion of built work as worthy of scholarly attention (Davis 1999). Recent efforts by some architectural historians and theorists shifts away from the art-historical tradition centered on individual creators to focus on the sociopolitical context of buildings (Cuff 1992). In *Architecture and its Interpretation* (1979), for example, Juan Pablo Bonta argues that architects and individual buildings achieve canonical status over

time, by the development of a shared interpretation within a particular historical and social context. The meaning of an architectural work or a body of work by an individual creator is constructed through social consensus by historians, critics, and to some extent architects (Bonta 1979). The architectural canon, consisting of the architects and buildings deemed significant, is developed and perpetuated through literature (Bonta 1979 and 1996). Both scholarly and popular literature presents and reinforces what architects are and what they do, by crafting narratives about the individual creators of buildings. Critics, historians, and architects highlight selected individuals in their depictions of architectural practice, so that what the layperson, including future architectural students, learns about architects generally focuses on an architect-hero.

In architectural education, students learn the history of and theories about architecture, predominantly through learning about the architects and buildings represented in the canon. Additionally, a significant portion of their courses are design studios, where students are socialized or indoctrinated into the ways of being an architect (Cuff 1992; Stevens 1998). The American Institute of Architecture Students (AIAS) created a task force to examine "studio culture" which is recognized as a term that describes commonalities across diverse studio instantiations, each of which will have unique characteristics based on particular institutions, programs, and instructors. The AIAS Studio Culture Task Force report addresses values that permeate architectural education, which are described as myths that "influence the mentality of students and promote certain behaviors and patterns" (AIAS Studio Culture Task Force 2008). When considered thematically, fifteen myths address how students should not:

- Give up personal health, well-being, and sleep;
- Sacrifice social, political, and personal engagement beyond the studio and architecture community;
- Falsely believe that architecture is an individual activity and collaboration is harmful;
- Prioritize studio work above all other academic pursuits;
- Assume they have no power.

The aim of the Task Force is to bring attention to expectations, behaviors, beliefs, and values that can be problematic in the development of architecture students and, by extension, the field of professional practice. One of these themes is that the perception of an individual doing creative work misleads students in its dismissal of the roles of clients, users, and collaborators in architecture (AIAS Studio Culture Task Force 2008). In the years since the Task Force's inception, many schools have responded to the Task Force by developing policies regarding studio culture, but it is not clear how well these policies are enforced. The emphasis on individual project design in architectural education can affect student perceptions about what it means to be an architect and can be linked to later professional disillusionment. When entering the job market, architects find that one's work at a firm might entail a small amount of design work on a portion of a project, but also negotiating relationships with various stakeholders in frequently changing circumstances, and varying degrees of autonomy and authority within a complex and diverse industry (Gutman 1985 and 1987; Cuff 1992). Indeed, each new professional faces a wide variety of participants in the world of everyday architectural practice and building culture.

Architectural practice involves complex and uncertain relations among people

Sociologists demonstrate the social complexity and uncertainty of relationships in architectural practice by examining the range of people involved in the planning, design, and construction of buildings; the continual changes that must be addressed throughout every architectural project; and roles of architects in everyday practice. Dana Cuff uses a cultural analytic framework to explore language, behaviors, roles, and power relations in the architectural profession. She asserts that, by focusing predominantly on creative individuals, the profession obscures complex working practices, in which the individual is part of the social construction of architectural artifacts. Cuff asserts that architecture is a collective practice, meaning that professional practitioners work together for practical, economic, and cultural reasons. Working within a firm allows individuals to specialize in particular parts of architectural work, while contributing to large-scale high-profile and profitable building projects, and participate in creating a meaningful professional identity (Cuff 1992). Part of architectural work involves "maintaining groups of people who can work well together" (Blau 1984, 10). Albena Yaneva describes the collective work practices at the Office for Metropolitan Architecture (OMA) in Rotterdam, where the network of actors involved in project design includes "architects, engineers, contractors, consultants, drawing software and drawing hands, boards and tracing paper" (Yaneva 2009, 11). Project design begins over models at communal tables at OMA, as opposed to beginning with an initial conceptual sketch by a lead architect that then undergoes revision by junior architects. Drawing heavily on Latour, Yaneva describes an OMA design as a “relational effect, of a whole network,” not the object of iterative transformation that other

firms produce as a design concept moves from sketch to built work (Yaneva 2009, 11).

While Yaneva's distinction in process in worth noting, it is important to highlight that both ways of working involve collective practices. Whether gathered around tables creating experimental models or negotiating changes to a design through successive iterations of a drawing, each process of design involves multiple actors in the development of a project. Yaneva's ethnographic account explicitly acknowledges the role of the non-human actors in the design process, which speaks to the value and role of artifacts in architectural practice. The artifacts created through each process constitute evidence of architectural practice. The physical *makings*, in this case collaboratively constructed experimental models at OMA or collections of iterative sketches and drawings commonly produced at other firms, can document the performative *doing* of design. Models constructed in the OMA design process can serve as traces of the particular situated methods employed at the firm, while a variety of hand-drawn sketches, layered CAD files, and contract administration documents can illuminate the coordinated activities of another firm. It is the accumulation of these varied makings, in whichever form they take, that enriches the stories we can tell.

Looking beyond situated design practices, the network of participating actors in a large building project will include various members of an architectural firm, the client, users of the building, engineers, contractors, vendors, regulating authorities, community representatives, and potentially consultants and partner firms (Cuff 1992; Schmidt and Wagner 2004). In the complex social network, architects face a great deal of uncertainty in their work. Cuff (1992) attributes the professional uncertainty to the continual changes that

occur over the span of an architectural project – from the people involved at various times, to the level of control and responsibility of various participants, and the methods for decision-making and taking action. Blau (1984) acknowledges uncertainties such as changing costs and regulations, the multiplicity of solutions to design problems, and the lack of a unifying theoretical foundation. These uncertainties contribute to a sense that each project is a unique problem to be solved and that the role of the architect is to manage the uncertainty, to oversee and lead the project throughout its development (Blau 1984; Cuff 1992). During the development and construction of a project, an architect's role is frequently to serve as a liaison between and coordinate the efforts of many disparate actors, using drawings and contract documents to communicate and manage information (Cuff 1992). In these ways, artifacts are actors in the process by functioning as guiding documentation for a project and evidence of choices made to reduce uncertainty. They also play a role in demonstrating knowledge, expertise, and authority.

Architects communicate knowledge and expertise through negotiation

The iterative nature of architectural work and continual changes over the course of a project means many, if not all, decisions are open to negotiation within the complex social configuration described above. Dana Cuff claims "as experts, architects can open and close lines of inquiry with their authority and knowledge of the process" (Cuff 1992, 93). What exactly is this expertise? What does expert architectural knowledge entail? Throughout the sociology of architecture literature discussed in this dissertation, a unifying theme is that the role of the architect is to coordinate the activities in building culture. Robert Gutman

(1977) argues that the specific value added by architects to building conception and construction is an aesthetic element, as well as an understanding of practical, financial, and spatial requirements of design and building. Expectations of architectural knowledge are changing with "new building technologies, new patterns of real estate and land development, and new techniques of information processing in design" (Schön 1983, 15). In negotiations, with clients, contractors, or other participants, architects maintain control over a project by demonstrating their knowledge of building systems, codes, and technologies and utilize their previous experience to justify their authority (Cuff 1992). One way that architects represent and communicate their knowledge is through artifacts.

How might we study doing and making in architecture? Several of the scholars presented here focus on the everyday situated practices in architecture. By examining practice-oriented scholarship, I will consider how to study people and architectural artifacts in everyday practice.

HOW DO WE EXAMINE EVERYDAY PRACTICE?

Sociologists and anthropologists contributing to science and technology studies (STS), human-computer interaction (HCI), and organization studies have developed methods and theories for conducting research on complex workspaces. While drawing from a range of theoretical foundations, Bruno Latour, Andrew Pickering, Lucy Suchman, and Wanda Orlikowski, to name only some, have contributed new theories and terminology to the growing body of literature on everyday practices within the workplace. Key themes

that emerge from the literature are:

- In situ studies benefit from proximity to localized practices.
- The social and the material (or technical) are entwined, not separate.
- Humans and non-humans have agency.

As in the previous section, I will examine these three themes in turn.

In situ studies benefit from proximity to localized practices

In taking an anthropological approach to the study of scientists, Bruno Latour and Steve Woolgar (1986) present empirical material gathered through in situ observations of scientific activity. Latour conducted field research at the Salk Institute during a twenty-two month period (October 1975 – August 1977), during which he worked at the Institute as a technician, while openly observing the everyday activities of scientists. In an effort to "retrieve some of the craft character of scientific activity," to help outsiders understand and appreciate how science is done, Latour sought active engagement with a particular setting in which the activity happens (Latour and Woolgar 1986, 28-29). Through in situ study, Latour had access to specific, local scientific activity over time to examine how scientists make meaning, produce order and construct scientific knowledge. Latour is operating from the assumption that knowledge is constructed, by the scientists and by him, through everyday activities.

Lucy Suchman, in *Human-Machine Configurations* (2007), states that she aims to "explore the relation of knowledge and action to the particular circumstances in which knowing and acting invariably occur" (177). Her research perspective embraces the

complexity of actors and artifacts in relation in specific localized context. Ethnomethodology, as a theoretical approach, is grounded in the study of lived practice and the assumption that understanding of situated actions evolves through ongoing activities and interactions. To interpret action, one must acknowledge that the action is situated in particular social and material circumstances. Suchman is responding to research in cognitive science that uses abstract representations to isolate a phenomenon for investigation, removed from particular circumstances. In Suchman's original *Plans and Situated Actions* (1987), she identifies "plans" as representations of the world that are inherently vague, but useful artifacts "of our reasoning about action" (2007, 60). Dana Cuff shares an ethnomethodological theoretical framework that is based on "everyday sense making and the social construction of reality" (1992, 6). In their approach to different subjects, Suchman and Cuff embrace an exploration of context and meaning-making within particular, everyday practices.

The social and the material (or technical) are entwined, not separate

In the introduction to *Shaping Technology/Building Society: Studies in Sociotechnical Change* (1992), Bijker and Law present a socio-technical perspective that problematizes the distinction between the technological and the social in an effort to provide a theoretical framework for examining the processes through which socio-technical artifacts are shaped. The key social issue they are addressing is, "how is it that actors (people, organizations) are both shaped by, but yet help to shape, the context in or with which they are recursively implicated" (Bijker and Law 1992, 10). This notion

resonates with my questions about what is happening in architectural practice with regard to the social coordination of humans and technological artifacts, particularly of the interplay between people and a variety of technologies. I am making a choice for the moment to align myself with an intellectual band of misfits that share these interpretive lenses, even if they might not all use the same definition of "sociotechnical."

Practice-oriented theorists are focused on studying how work is done in the various communities under investigation. Some share a commitment to break down or move beyond binary relations such as social/technical or human/nonhuman. Theorists describe the relation of humans and technologies using a variety of terms developed to express the relationship between the material and the social. Wanda Orlikowski (2007, 1437) lists a few of these ideas and their proponents: *actor-networks* (Callon 1986; Latour 1992; 2005), *sociotechnical ensemble* (Bijker 1995), *mangle of practice* (Pickering 1995), *object-centered sociality* (Knorr Cetina 1997), *relational materiality* (Law 2004), and *material sociology* (Beunza et al. 2006). Orlikowski (2007) identifies a theoretical theme in the literature listed above: each proponent makes the effort to consider the social and the technical or the social and the material not as separate phenomena for investigation, but as performing in a relationship that continually emerges in practice. The theme also emerges in Pickering (1995), MacKenzie and Wajcman (1999), and Suchman (2007). "The technological, instead of … separate from society, is part of what makes society possible – in other words, it is constitutive of society" (MacKenzie and Wajcman 1999, 23).

The technological consists of material artifacts created by humans in society. These artifacts are part of what constitutes society. Most human relations involve artifacts, and

material artifacts and human beings are in socio-technical relation. In architecture, material artifacts such as drawings, models, correspondence are integral to everyday practice. The iterative nature of architectural work and continual changes over the course of a project means many, if not all, decisions are open to negotiation within the complex, messy configuration of people and material artifacts in everyday architectural work.

Agency is not a uniquely human capacity

One of the defining features of actor-network-theory (ANT), as described by Bruno Latour, is the status or role of nonhumans as actors. Latour poses two questions to help determine the status of an object: "Does it make a difference in the course of some other agent's action or not? Is there some trial that allows someone to detect this difference?" (2005, 72). His purpose is to extend the examination of social activities to include all potential actors in the action under investigation. Objects are actors while visibly interacting, making a difference, having an effect on actions in the world. Latour makes a distinction between agency and intentionality, stating that "any thing that does modify a state of affairs by making a difference is an actor" with agency, without granting intentionality to non-human actors (71). Only humans have intentionality, but objects have agency in that they are participants in the action.

For Latour, it is the observable traces between agents within a network that are worthy of concern. Objects, or non-human agents are more difficult to trace, so "specific tricks have to be invented to make them talk, that is, to offer descriptions of themselves, to produce scripts of what they are making others—humans or non-humans—do" (79). In

terms of defining agency, Latour's work has been influential in developing a notion of non-human agency and asserting that we must be open to multiple types of agencies to consider all participants in the science of the social.

John Law, in *Organizing Modernity* (1994), grapples with agency as it relates to social ordering. He includes his interpretation of agency in ANT, stating that agency in ANT (as he understands it) is constituted by agents in association with one another; in other words, they are relational (or network) effects. Law, less forcefully than Latour, suggests that agents need not be people. For him, there is uncertainty, but the key issue revolves around being able to state that something *acts*. Much like Latour's idea of making a difference or interacting, for Law agency seems to rely on acting, and mostly *inter*-acting, with others – both people and objects – in the world. Law is not focused on individual agency as much as the networks created through arrangements between and around people and the complex ordering processes that include non-human materials.

In John Law's theory of agency "the patterns or arrangements of machines, of bodies – and we could add texts, architectures, and conversations and many more – perform/embody incomplete orderings" (1994, 129). There is no single story, but continually evolving performances and attempts at ordering. Instead of static agents, objects, orders, stories – these are "better seen as verbs rather than nouns" (2). They are in process, always incomplete, in action. Questions of agency become questions about how we label things, how we create distinctions, how we are continually ordering the world around us.

In *The Mangle of Practice*, sociologist Andrew Pickering argues that human and

nonhuman actors are “inextricably entangled” (1995, 26). He de-centers humans as the continual subject and center of action within scientific activity, in opposition to usual human-centered sociological practice. The human is no longer the sole focus of the social researcher. In his understanding of scientific practice, the "basic image of science is a performative one, in which the performances – the doings – of human and material agency come to the fore" (21). The distinction between human agency and non-human agency, for Pickering, lies in the temporal nature of human agency, in that there is human intentionality – an orientation to the future through the projection of goals or plans. Pickering's mangle is the "temporal pattern of practice" that can be studied, in specific instantiations (147).

One of his aims in the book is to engage ANT. His reading of agency in ANT involves symmetry "with respect to human and non-human agency," wherein neither is privileged over the other and the two should be considered simultaneously (11). Latour addresses symmetry in *Reassembling the Social* (2005), stating that ANT is not an attempt to establish symmetry between the two, but to question distinctions and look at the associations between human and non-human agents. Pickering maintains the distinction between what he terms "human" and "material agency" because of his experience of the differences in practice. He notes that his understanding of ANT points to important distinctions between human and material agency and to the significance of an entanglement between them (1995).

Once again, the primary distinction involves intentionality, which Pickering describes as a particularly human organizational trait. Humans typically have a future in view, a plan of action, and these plans are created and changed through interactions with

material agents. In the mangle of practice, the "dance of agency" involves continual tuning, goal setting and goal adjustment processes that emerge through the interactions between human and material agents. Another way to think of human intentionality is to consider how humans attempt to gain control over their work practices. Humans are not the only agents, but their temporally emergent intentions are singularly human components of their agency. Humans and non-human agents are engaged in performative activities, wherein agents act and re-act to temporally emergent circumstances. Pickering's concept of material agency helps move beyond notions of objects as mere representation and allows for a performative understanding of work activities. He clearly states, as a departure from Latour and Law, that these interactions are "always situated within a space of human purposes, goals, plans" (1995, 54).

Lucy Suchman, in *Human-Machine Reconfigurations* (2007), begins with a simple definition of agency: "the capacity for action" (2). She describes agency in ANT as existing within configurations of humans and non-humans, as opposed to located within either or both individually. Her reading of Pickering focuses on his use of time and identifies agency as temporally emergent. Through her review of empirical studies on sociomaterial practices, she reveals the theme that agency, particularly sociomaterial agency, has been shifted to "an effect of practices that are multiply distributed and contingently enacted" (267).

Suchman, while acknowledging her debt to studies that discussed symmetry between humans and non-humans, now calls for articulation of the asymmetry between humans and non-humans. She states that "agencies reside neither in us or our artifacts but

in our inter-actions" (285). In her work on the complexity of humans and artifacts, she builds on Pickering's notion of agencies in practice – they are mutually constitutive but not symmetrically. The research space is in the interactions between agents (human or non-human) with the capacity for action.

Agents, both human and non-human, act in the world, make a difference in everyday activities, have an effect on interactions, and contribute to networks of actors that make things happen. For the purposes of my research, agency is the ability to be an active participant in action. Agency is configured in interactions with other participants, whether human or non-human. Intentionality involves determining which actions to take in practice and how much one agent feels and asserts control over another agent in a specific interaction. I see control as the ability to effect change based on one's intentions.

My research space is in the interactions between actors with agency and the intentions of human actors toward the non-human artifacts. If we grant that agency is the capacity for action in interactions with other agents, both human and non-human, then my research questions can be extended and framed by focusing on agents: how do humans and non-human agents interact in everyday architectural practice? For that matter, how do interactions with any other agents in architectural practice contribute to the perceived value of artifacts? Through intentionality, human actors make judgments about the value of non-human architectural artifacts by determining what to keep, what to discard. How are these judgments made?

SITUATING MYSELF AS AN ARCHIVIST

I actively accept the role of participant in the decision-making practice of determining value for architectural artifacts. Terry Cook's "Evidence, Memory, Identity, and Community: Four Shifting Archival Paradigms" (2013) sets up a history of archival identity, and the role of the archivist, as he sees explained through four successive frameworks. In the first, records are "evidence," or the "residue" of bureaucratic records (106-107). The role of the archivist was the curator and guardian of those records. The early conception of the archivist was based on Jenkinson's theory of archives, in which records should be preserved as evidence of the context in which they are created and the archivist is not responsible for making selection or appraisal decisions (Cook 2013; Ridener 2009). In the second framework, appraisal came under the purview of archivists during the second half of the twentieth century, when the volume of governmental records increased and interest in social history meant that far more records were kept (Cook 2013). The archivist took an active role in selecting records, in constructing archives for historical purposes, thus contributing to the fairly narrow construction of cultural "memory." During this period (1930-1970), based on Schellenberg's definition of a record (which owes a debt to records management), archives began collecting records "on any media" (Ridener 2009, 83), which included textual materials as well as "photographs, sound recordings, maps, architectural records, and moving images" (Cook 2013, 109). Since 1970, Cook argues that archivists have responded to other academic fields beyond history and have engaged postmodern theory, leading to an interest in documenting the lives, work, and communities of a wide range of people in addition to governments (2013) in the third framework.

Proponents of working within the first two frameworks (evidence and memory) came into tense conversation about the identity and role of the archivist. On the one hand, archivists function as experts who can determine what a record is and how to protect the evidentiary value of records. On the other, archivists are experts in mediating multiple perspectives to make decisions (and ask questions) about which records have value in reflecting activities and multiple perspectives as documentary memory (Cook 2013).

Cook's primary concern about the third framework is that there remains an archival identity crisis dividing archivists. The most attractive element in Cook's analysis is that he presents these frameworks (or paradigms, a term which he uses begrudgingly) as successive iterations of archival practice and theory. Not either/or positions, but layers of complexity in the development of archival identities. Cook's fourth framework, "community" involves an attempt to reconcile the three prior mindsets in the development of an archival identity that couples experts' knowledge about evidence and memory. The archivist's role may then extend beyond the traditional position as curator, steward, guardian to consultant, collaborator, mediator (Cook 2013).

I use the term "artifacts" to remain open to extending the body of potential records beyond those that have been typically collected in architectural archives and to connect to work practice literature. Consider the following definitions of archival records and architectural records, from Pearce-Moses (2005):

> ***Archival record:*** *Materials created or received by a person, family, or organization, public or private, in the conduct of their affairs that are preserved because of the enduring value contained in the information they contain or as*

evidence of the functions and responsibilities of their creator.

Architectural record: *Documents and materials that are created or assembled as part of the design, construction, and documentation of buildings and similar large structures, and that are preserved for their administrative, legal, fiscal, or archival value*.

Archival value is key to both definitions. My use of the term "artifacts" stems from a desire to approach appraisal by addressing the activities, the actors, and the processes in architectural practices before considering the record-ness of the resulting artifacts and determinations of value. But I also argue that determinations are always happening in practice, in the construction of artifacts.

Geoffrey Yeo, in writing on the various meanings of the term "record" in archives and records management, proposes the definition that records are "persistent representations of activities, created by participants or observers of those activities or by their authorized proxies" (2007, 24). He is providing one lens through which to define records, in response to other definitions of a record as evidence or information. I find value in his attempt to focus on the relationship between a record and an activity and in his inclusion of many affordances of records. Such affordances include records as evidence and information, as well as communications and memories (Yeo 2007).

If we assume Yeo's definition of records as representations, are records just the residue that remains from activities? Can records still be active participants in practice, both architectural and archival? Are they active in architectural practice but become representations once they cross over into archival record-ness? And, if digital preservation

requires active (recordkeeping) engagement from the moment of creation, when does this shift happen? One way to address some of these concerns is to consider the life cycle of records vs. records continuum debate, which also brings records managers and archivists into the picture.

In the life cycle of records perspective, there are "distinct phases of a record's existence, from creation to final disposition" (Pearce-Moses 2005). There are various descriptions of the life cycle model that speak to the management of records and responsible actors at certain times using varying terminology drawn from archives and records management theories and practices. I will use Philip Bantin's analysis of the life cycle of records here, which is explicitly concerned with electronic records. Bantin describes the life cycle model and asserts that it defines who manages records at various stages (1998). The first stage involves the initial making of the record in a particular context, pointing to the creator as the responsible agent. Stage two is a period of active use when the creator, whether an individual or collective body, maintains the record for use in everyday activities. When the record is no longer of everyday value, it is destroyed or enters stage three, based on determinations made within the creating office. Records are considered semi-active and are retained until someone (a records manager) determines, through another review process, if the record has enduring value (Bantin 1998). According to Bantin, the role of the archivist is limited to the fourth stage, when the few records that have enduring value are preserved and made accessible. Records managers play a greater role in making determinations along the way about which records have value as active participants in everyday activities. The sharp divide between the role of record managers

and archivists depends upon the characterization of a record as active or inactive, as subject to destruction or worthy of preservation, and as a product of activity and actors.

In the records continuum model, records are "recorded information made up of the documentary traces of social and organizational activity" (McKemmish, Upward, and Reed 2010, 4447). As opposed to drawing distinctions between the phases in the life of a record, the continuum approach employs "a multidimensional view" that includes "creation, capture, organization, and pluralization" as four processes. Documents are created that carry traces, or representations of activities by actors in the first dimension. Recordkeeping begins in the second dimension at capture and continues through organizing and pluralization. Pluralization recognizes multiple stakeholders, layers of meaning, and different (potential) contexts. The continuum emphasizes how records are always in the process of becoming and are not time-bound (Pearce-Moses 2005) or limited to simply being products of activities (McKemmish, Upward, and Reed 2010, 4447). But records still "become records when they are stored and managed by recordkeeping and archival processes" (McKemmish, Upward, and Reed 2010, 4447). A primary contribution of the records continuum, in my estimation, is the shift from distinct differentiation between the roles of creator, records managers and archivists in terms of making record-keeping decisions. "The Australian scheme does not neatly split the life cycle into 'creator' and 'archival' custody requirements" (Galloway 2004, 564).

In terms of situating my archival thinking in my research, I am drawn to the lifecycle continuum conception of a record for two reasons. First, a definition of record that "emphasizes their evidentiary, transactional, and contextual nature" and acknowledges

the multiplicity of meaning of records (McKemmish 2001, 333) is in line with my own experience in archival practice and in research. The idea that records can take on different meanings at different times, for different people, in different contexts is part of the complexity I address in my research. The record may operate in multiple ways – as evidence, information, memory, in contextual interactions. McKemmish writes, "in continuum terms, while a record's content and structure can be seen as fixed, in terms of contextualization, a record is "always in the process of becoming" (2001, 333). Secondly, I strongly feel that in order to preserve records created in architectural practice or any digital practice, the responsibility and concern for preservation must begin early, at or before record creation. The continuum model breaks down the temporal designations between record managers and archivists, pointing toward the collaborative and flexible relationships between creators and record keepers (whether managers or archivists). Expert knowledge of record keeping and multiple values of records to many communities of users, as called for by Terry Cook (2013), could be the archival role, as one of many actors in the record keeping practices required to manage and preserve archives.

In describing artifacts as actors with agency, the ways I represent their actions correspond to the roles and affordances of records: artifacts contain evidence, provide information, communicate expertise, contribute to legacy (memory). The multiple, overlapping communities that socially construct the value(s) of architectural artifacts are all actors, or agents, including record managers and archivists that effect the capture and preservation of architectural records. In a 2011 paper in *Art Documentation,* "Collaborative Efforts to Preserve Born-Digital Architectural Records: A Case Study Documenting

Present-Day Practice," I described recent efforts to preserve digital architecture records and called for a network of experts to work together to address the long-term preservation challenges of architectural artifacts. My research presented here is an opportunity to engage appraisal from within architectural practice by asking architects questions about what records are worth creating, worth keeping, and why. I am seeking to address how we can make decisions about artifacts based on what we can learn about the history, technology, and everyday work in architectural practice.

CONCLUSION

In Chapter 2, I have demonstrated that artifacts of architectural practice have agency, defined here as the ability to be an active participant in action. The sociology of architecture literature presented here debunks the myth of the solo architect, introduces complexity and negotiation as key to architectural practice, and begins to build an argument about the role of artifacts as active participants in architecture. Workplace literature provides a framework, a theoretical perspective from which to approach studies of the particular circumstances of architectural practice, and ways to consider how humans and artifacts (non-humans) co-exist, interact, and are co-constructed everyday. What can we know about architectural practice? What can we know about architectural information? Decision-making about which artifacts to make, keep, share, organize, and discard fall to the human actors in architectural practice. For these artifacts to illuminate practice and help us tell stories about the design of the built environment, it will be necessary to make thoughtful intentional decisions about which artifacts have value.

To feel prepared to engage in thoughtful decision-making, and as a result of recognizing the complexity of practice and the multiplicity of perspectives, my research needed to address how we arrived at this present state. I had to determine what the conditions are under which technologies for architectural practice were created, what these technologies currently do, and how architects characterize their interactions with and through these technologies. Chapter 3 follows and tells a story about how I collected and analyzed data about these topics, in order to understand how artifacts are simultaneously the result of decisions made by multiple people, are active agents in practice, and are material traces of work.

Chapter 3: Research Design

Working from a critical constructivist framework and employing an interpretivist methodology, I have used mixed methods to provide an understanding of the history of architectural and archival practices in which to situate my analysis. This research approach provides varied, and potentially conflicting, narratives about artifacts in architectural practice. The study is fundamentally a social examination of the culture of practice, wherein decisions and negotiations are made every day that have implications for what is made, what is kept, and how we will construct future narratives about building culture and the construction of the built environment.

My critical constructivist framework situates the research project at the intersection of historical analysis of a culture of practice and engagement with members of a community of practice. I am also operating from within a community of practice, specifically as an information professional engaged in conversation about digital assets in architecture, design, and engineering. My research makes a contribution to that space by providing a concrete case of a project team in contemporary architectural practice and the artifacts of their work, as well as continuing to build my own expertise through learning to use the software and engagement within the firm. Bent Flyvbjerg identifies value in "the closeness of the case study to real-life situations and its multiple wealth of details" for developing skills from context-dependent research (2006, 223). I brought my evolving expertise as an archivist/librarian and as a researcher to my interactions in the study. I will bring knowledge from the study about the history of technology for architecture and my

lived context-dependent experience into conversation with members of my own community of practice.

Both critical theory and constructivism involve making meaning through interaction and negotiation with the object of inquiry, and I find myself engaging many assumptions in the conception of my research study. A culture of architectural practice has developed in which there are multiple voices and multiple narratives about practice. There are structures guiding and perpetuating the culture of practice, but the culture is also continually open to shifts in beliefs and values, with resulting implications for practice. The architectural information system is both a means of communication that permeates the practice of architecture and a way to examine how architects have thought, spoken, and written about their work.

Understanding contemporary architectural practice requires engagement with historical materials that point to how the field developed and what the material reality of architecture has historically entailed. To understand current cultural conditions, it is helpful to look at sources that illuminate narratives about previous conditions and norms. Cultures of practice shift over time, and the discourse of architecture as a field gives insight into its changing beliefs and values. Beyond trying to gain an understanding of the narratives around architecture, I am working from the assumption that, by engaging individuals in an architectural firm, I can come to understand something about the current culture of architectural practice. Historical sources can provide a sense of the dominant narratives present in architecture, but, through active engagement with current practitioners, I can seek other voices and other perspectives on the field.

I chose a narrative approach as a way of address my particular situatedness in the study and to maintain a closeness to the situation. In this personal narrative, I am telling a story about my own research in practice, about learning and finding a way to do research, about making messy maps to visualize activities, how my own perspective (as archivist, historian, librarian) informs what and how I am seeing, and how I have developed a way to address my questions and bring this way of seeing into my professional practice. Flyvberg states "If researchers wish to develop their own skills to a high level, then concrete context-dependent experience is just as central for them as professionals learning any other specific skills" (2006, 223). Through my narrative, I seek to ask questions from multiple perspectives, but I am primarily driven by a tension within my own practices. As an archivist, I understand the value of making appraisal decisions and the limitations to collecting, describing, and making large quantities of records available. As an academic library and archives professional, I understand the space, time, staff, and money constraints of collecting institutions. As a historian, I understand the usefulness of records that might easily be seen by others as insignificant or outside the scope of what should be collected. Each of these roles frames the way I approach my research as well as my professional activities and decision making. I chose to tell this story in a personal way to acknowledge that there are always individual people who make decisions about what has value, what gets kept, how we describe artifacts, and who has access. I am one of those people and will continue to make decisions in a mindful, ethical, and deliberate way.

PILOT: DOCUMENTING ARCHITECTURAL PRACTICE (DAP)

In my pilot study, "Documenting Architectural Practice," I used ethnographic methods based on my informed assumption that engagement with activities in architectural practice would allow me to study digital technologies at work. My goal was to determine what tools architects were using and to learn something about how to preserve digital architectural records by virtue of seeing how they were made. I conducted the study at an architecture firm using interviews and observations. The interviews aimed to let human actors in the firm speak about their work using computer technologies and to inquire about their technology choices and preservation practices. Observations provided an opportunity to watch the participants interact with various technologies and with each other.

I submitted an application to the Institutional Review Board (IRB) in March 2010 for the interviews and observations I planned to conduct for this pilot study. To receive approval, I provided a letter of approval from the lead architect, who is a principal at the firm. I indicated that participants would be recruited through direct contact with the firm's staff and that I would identify members of the staff that could provide information about the use and management of digital project records and would seek interviews with those individuals. I also submitted a consent form, which outlined the purpose of the study, expectations for participants' time, and my commitment to maintain confidentiality. My study was approved in June 2010. Documentation of the IRB approval is included in Appendix A.

I conducted five semi-structured interviews over the course of two months. Each participant was interviewed once, with sessions ranging from 40 to 80 minutes. The

interviews were conversational in tone and designed to allow participants to describe their roles and responsibilities within the firm, the nature of their work relationship with others, the technologies they employ in the everyday conduct of their work, how digital technologies are acquired and implemented in their work, and how their use of technologies has changed over time. Each interview was conducted at the firm, during normal working hours. The architects each requested a conference room for the interview, while the graphic librarian elected to be interviewed at her desk. The facilities manager found a small, unoccupied office (away from his open desk area) to use for the interview. All interviews were digitally recorded and partially transcribed for analysis.

I observed four of the five participants in their working environments. The facilities manager was unavailable for observation, due to the hectic and ever-changing nature of his position. Two observations were scheduled with him that were subsequently cancelled. I conducted six total observation sessions, ranging from 1 hour and 20 minutes to 2 hours. I observed both senior associate architects working at their desks, using a recently implemented technology as well as the other tools they use on a regular basis. For my observation with the lead design principal, I was able to observe a design team meeting with the lead, one of the senior associate architects, and three other members of the team. I observed the graphic librarian at her desk, using the digital asset management program to manage project images and logos. I took extensive notes during observations, many of which became conversational as the observed participant used the opportunity to "teach" me about the new technology they were, in some ways, learning themselves.

As expected, I came out of that initial study with first-hand experience of the

complexity of architectural practice and more questions than answers. In writing about the research experience now, I find I am retroactively applying some of the language I have adopted in the years since through my choice of socio-technical framing because it helps explicate the activities, choices, and interactions I witnessed. What I found in the pilot study will be discussed in more detail in Chapter 5, but it is important to address how the pilot informed the development of the dissertation research. In Table 1, I present my observations from my pilot study and the associated methodological implications for the full dissertation.

Pilot Study Observations	Methodological Implications
Architectural practice requires complex interactions between people using a variety of tools, creating many artifacts.	Research must focus on people and artifacts.
The workplace is organized for team-based project coordination.	People and technologies are intertwined in performative relation.
An extensive range of paper and digital artifacts are used as visual representation, documentation, and communication devices.	Artifacts are active agents.
Decision-making involves continual negotiation.	Value is socially co-constructed.

Table 1: DAP Pilot study observations and methodological implications

Once I began the pilot study, I realized much of the firm's work was done collaboratively. I observed one design meeting, where the interaction among multiple architects and design drawings revealed how many decisions are made through iterative

processes. Ideas were exchanged as the project team members tried, evaluated, discarded, and suggested various design options. In the design team meeting, five architects met to discuss the design of a building. The lead designer and a project architect worked out design solutions, marking a printed computer-aided design drawing with their changes in pen and pencil. After the meeting, the project architect took the printed drawing back to his desk to revise the design in AutoCAD. This brief example illustrates how design decisions were made through team-based collaboration that resulted in multiple iterative artifacts, how the team members used many technologies in their work, and how paper records as well as digital records played a role in their design. Seeing architectural artifacts both in the process of becoming (as they were made, evaluated, and revised) and as performing in everyday decision-making changed my thinking about the research. My questions began to shift from which digital records to preserve to how to investigate the mutually constituted collaborative relations between people and technologies that result in architectural artifacts.

Based on the intense collaboration between people and various technologies, I could no longer focus on the artifacts created, but needed to look at the interactions between people and the artifacts. Through my pilot study, I began to think about the implications for negotiated decisions made over time within a firm, whether about a building design, technology adoption, or which files to maintain. I heard about different perspectives on software programs, often situated within the context of an individual's knowledge of industry trends. I determined that increasing my own familiarity with particular software would be useful for making record-keeping decisions while also expanding my ability to have meaningful conversations with architects about their work. I became aware of the

network of people, even within the single firm, that was involved in decision-making about technology, artifacts, and preservation.

METHODOLOGY

As described above, my research project has developed through an iterative process of data collection, reflection, and reading. Adopting Adele Clarke's situational analysis methodology, an example of a method where "the person doing the research is the 'research instrument'" (2005, 85), I have selected a tri-partite methodology to systematically approach three distinct but inter-related units of analysis: the industry, the individual, and the project team. I discuss each of these in turn in this section.

As described in Chapter 1, I adopted a socio-technical approach to examine interactions between humans and artifacts, in response to my shift to focus on the complex coordination of people and technologies. The story I want to tell about architecture requires investigation through three methods, each addressing one of the primary concerns of my research:

- Historical examination of computer technologies for architecture;
- Reflective analysis of my learning architectural technology;
- In-situ investigation of people and artifacts in practice.

Table 2 briefly describes each research method and the relationship of each to the following research questions, first introduced on page 15:

- How might architectural artifacts be preserved in ways that illuminate the complexity of practice and the multiple layers of assumptions and values that inform the co-construction of the built environment?
- What is the role of artifacts in architectural practice?
- What are the processes that lead to artifact creation, destruction, and preservation?
- What do artifacts reveal about architecture?
- Who makes judgments about which artifacts to keep in everyday practice?

I address these questions directly in Chapter 6.

Research Method	Relationship to the Research Questions
Historical examination of computer technologies for architecture.	▪ Addresses continuity of architectural artifacts by seeking to understand development of technologies for architecture. ▪ Presents evidence about the complexity of the industry, variety of assumptions and values about the role of technology. ▪ Introduces other stakeholders in the archival challenge: software creators.
Reflective analysis of learning architectural technology.	▪ Leads to familiarity with two tools – what do these tools do, what do they allow one to make? ▪ Allows the researcher to evaluate assumptions and complexity of the programs. ▪ Provides language and concepts to use when re-entering the firm.
In-situ investigation of people and artifacts in practice.	▪ Helps examine the complexity of practice by focusing on the people on one project team and the technologies used in their everyday work. ▪ Addresses what they make, keep, share, discard and how they make these decisions.

Table 2. Methods and the research question

Framing the study from a historical perspective is important because it is necessary to understand how architectural artifacts have been developed over time by specific people and groups whose values and decisions have implications for what is being made, what can be kept, and what artifacts can tell us about practice. The units of analysis in the history section are the people and groups within building culture who worked to develop, use, and market architectural technologies to the field. I begin by considering early explorations and debates about computers and architecture. Then, I examine the rise of a particular software company, AutoDesk, as a provider of tools specifically for the industry. Finally, I examine the relatively recent development of Building Information Modeling. My choice to focus on specific technologies, and even a specific software company, is informed by both my reading and my engagement within the situated context of the architecture firm, where these tools, the decisions to adopt them, and the implementation of the technology in practice have implications for how architects collaborate and what artifacts can or should be kept to document practice. My focus on specific tools reflects what I found in this local context, while further research could examine other tools in different contexts.

Working to learn how to use particular design technologies taught me about current widely used software that will be necessary to preserve, describe, and provide access to artifacts; and it allowed me to more deeply engage in the third part of the study. Understanding the software programs used in the pilot study helped me as I reestablished connections to individuals in the firm and asked them questions about their practice. I am the unit of analysis in the reflection, in my relation to the technologies I learned, as well as in my interactions with the teacher and other students. In the process, I reflect (as an

archivist/historian) on what I learned and how it informed my thinking about artifacts. When I returned to the firm, I brought insights from my knowledge of the history of these tools and my reflection into any conversations and observations that I had made about architectural work. By returning to the same firm, I focused on the people and the artifacts in relation, which I did not do in the pilot study. While I conducted additional interviews, the unit of analysis in the final of the three research methods is the interaction of people and artifacts, in their relationship to the work being done.

Historical examination of computer technologies for architecture

Architects began using computers in the creation of architectural drawings in the 1960s, with broad adoption happening in the 1970s. Since then, the development of computer-aided design (CAD) programs and more recently, building information modeling (BIM) software in the architecture, engineering and construction industry, has changed the way architects make drawings, store information, and communicate their design intentions. Records created since the 1960s using computer programs can be particularly challenging for information professionals to preserve, given the frequent technological changes, variety of tools used, and proprietary character of software programs. I briefly addressed the history of computer-aided design in this study, but there is a rich history to develop further.

I examined industry publications to identify published software reviews and advertisements. The American Institute of Architects' archival holdings include records about the software programs reviewed for the professional organization, and the organization's publications are a rich resource of information about the rhetoric about

computer technologies for architecture. This historical analysis addresses the information in architectural design practices and considers the development of CAD and BIM in the changing use of information in architecture by drawing on archival resources, industry publications, and previous studies of technology use in architecture. The focus is on changing technologies and changing practices, specifically how these changes over time have resulted in new artifacts with implications for preservation. Technology recommendations and choices made within the industry have important implications for current architectural practice and for information professionals seeking to preserve artifacts from the past 50 years.

Reflective analysis of learning architectural technology

To understand the changes in architectural practices and preservation implications for the resulting artifacts, we must understand the technologies used. How are artifacts made? As I have argued above, they are made in many different ways. Through my education as an architectural historian, I have some training in creating architectural drawings by hand and using CAD software. As part of my dissertation research, I engaged in a reflective analysis of learning to use computer-aided design technology in order to understand the individual act of using software designed for architecture. I focused specifically on AutoCAD and Revit, two software products by AutoDesk that I observed in use in my pilot study and that I identified as widely used in the industry through my examination of the history of architectural computer technologies. My selection of these programs and my interactions with the technology were informed by my interpretation of

the history as well as my engagement within the architecture firm from the pilot study. Learning these specific programs provided a way to gain hands-on experience with software as well as increased my ability to engage with architects through shared language about AutoCAD and Revit.

As a conscious methodological choice, training to use architectural technology is an active effort to change my frame of mind, or expand my perspective, about architectural artifacts. By increasing my technological literacy, I became more proficient at:

- Talking to architects about the technology;
- Seeing the technology in practice; and
- Reflecting on the doing (using architectural technologies) in a new way.

To conduct the reflective analysis, I participated in courses to learn AutoCAD and Revit. The Architectural & Engineering Computer Aided Design Department at Austin Community College offers hands-on week-long courses. I also used lynda.com as a supplemental resource, to access self-paced online courses. Throughout the training, I maintained notes on the process of learning, the challenges, and questions that arose for ongoing research.

Donald Schön describes "designing as a conversation with the materials of the situation" (1983, 78). While learning some of the tools of architectural practice, I tried to document myself as a designer reflecting-in-action. I am not by any means suggesting mastery, or even professional competency, with the software I learned. Understanding the software allows for increased understanding of the doing of architecture, which I focused

on in further field work. By actively engaging the technology, I engaged the doing of architecture and became a maker, even if in only a small way.

Engagement with doing and making in architecture

The primary benefit of my pilot study on technology choice and usage in architectural work was identifying some of the specific ways in which architectural practice is collaborative and messy. To ask questions with the objective of effecting change, it is necessary to embrace the messiness (Henderson 1999). Continuing my iterative research design, I revisited the firm I studied in Documenting Architectural Practice as a singular deep case study. I approached the same firm, Jackson Architects,[1] with a new theoretical lens, which I have developed in the years since my first visit. My two primary goals were to investigate the leads I did not pursue last time and follow the artifacts as well as the people. I focused my analysis on a single architectural project, the work on one building, examining the people involved and the artifacts that document the project. The selection of the specific project was done in consultation with informants at the firm. My primary contact identified a current residential tower project and the individual members of the project team.

I submitted an application for IRB approval for my study in June 2016. I again provided a site letter from the design principal at the architecture firm and a consent form. As opposed to my pilot study, where I was listed as a co-PI, alongside my faculty advisor, I received notice that my faculty sponsor would be on record as the PI for administrative

[1] Jackson Architects is a pseudonym.

purposes. As such, the formal documentation for my dissertation study, included in Appendix B, is addressed to my advisor.

To engage my research questions, I conducted semi-structured interviews within the firm, seeking opportunities to interact with people and artifacts involved in the particular architectural project. I recorded and transcribed these interactions, while taking active notes on what I saw in practice. The semi-structured interview questions were designed to engage people in discussion about their everyday practices at work and to gather data about interactions with other people and with artifacts. An interview schedule (see Appendix C) guided my interactions with individuals in the firm, but was revised as needed to develop meaningful conversations with respondents. The interview questions were not asked in this order or even explicitly, but a person's role(s), their interactions with others, the tools and technologies used in their work, and the decision-making processes within the firm were addressed throughout the conversation. I interviewed ten individuals at the firm, in addition to meeting with the senior principal, who facilitated access to the project team.

Two of the people I interviewed are project designers, which are described as a key part of the project leadership team. Both project designers I spoke with lead projects, functioning to shepherd the design concepts the senior principal outlines and to serve as the primary decision-maker in his absence. Any given project will have a project designer, a project architect, and a project manager. One project designer describes the responsibilities of each: "Project designer is criteria. Project architects are implementation. Project managers are really accountability. It's organization, coordination, and

accountability [for the project manager]." Despite my intention to focus specifically on one project, I interviewed two project designers (who oversee separate projects) because the second designer was highly recommended by both the senior principal and the first designer as someone who has particular insight into the use of new technologies and their implications for architectural practice. I interviewed both project designers twice, working from their recommendations to determine further interviews. Here is a brief, generalized description of the participants.

- Mike: Senior principal and Lead designer. He has been a licensed architect for over 40 years and also maintains a position as a professor at a major university. After joining the firm in the late 1990s, he has taken on the role of principal designer.

Project Team

- Aaron: Design principal, at the firm since 2008. Project designer.
- Jason: Senior associate, at the firm since 2008. Project architect.
- Lee: Senior project manager, at the firm since 2015, in the industry since 1988.
- Kelly: Associate designer, at the firm since 2014. BIM team manager. Studied under Mike in graduate school.
- Sarah: Designer, at the firm since 2014.
- Lisa: Architect and Interior designer, in field since 1988. Has worked at several firms in other major cities. Staff architect on project.

Firm-wide perspectives

- Mark: Design principal, at the firm since 2011. Project designer. Studied under Mike in graduate school.
- Mary: Senior associate and project architect, at the firm since 2006.
- Ben: Associate principal and IT software director, at the firm since 1998.
- John: Senior associate & senior construction administrator, at the firm 10+ years.

The interviews all took place at the firm, either at the interviewees' desks or in a conference room. Six of the interviews were with single individuals, one was with two people, and I conducted one group interview with members of a project team who worked together on a large residential tower. While I had a list of questions, my intention was for the interviews to remain conversational and to have the respondents reflect on their own practice. The project team interview included the project architect, project manager, and three staff architects/designers. One of the staff designers also functions as the BIM manager, which I will discuss in a subsequent section.

Most of the individual interviews took place at the interviewees' desks, which allowed them to show me their workstations and to observe the work of their co-workers. The architects each maintain one desk within a 4-desk unit, so Aaron, for instance, occupies a desk within a larger cubicle that he shares with Kelly, Sarah, and Jim (another project designer but one I did not interview for this study). The cubicles (4-desk units) have low walls, so, while they define the workspace of an individual and those who share the space, the walls do not limit visibility across the open office. A few of the individual interviews and the project team interview took place in conference rooms, which are located against the exterior walls and have glass walls, which maintaining visibility to the rest of the office.

I approached data collection and analysis with the intention of examining the people working in architectural practice, the role of artifacts in their practice, and how decisions were made, particularly those that have implications for the artifacts created, discarded, or kept every day. During the interviews I made selective notes, and I journaled following the interviews to record my impressions, follow up instructions, and further questions. All of the interviews were audio recorded and fully transcribed, using a professional transcription service.

I coded the interviews iteratively. I went through the interview transcripts multiple times and listened to the audio recordings during the first pass, which allowed me to clarify or correct any discrepancies or gaps in the transcripts. The initial coding resulted in 116 codes, which I then grouped into 12 nodes, using NVivo terminology. Nodes provided a way to group topics and concepts together. Following open coding, I went back to the research questions I was asking to reflect on how what I was hearing in the interviews and my codes related to the questions I initially set out to address. To extend my study beyond the pilot, I focused on addressing specific questions:

- Who are the people involved in the project, both within and outside the firm?
- What work is done collaboratively? What work is done by individuals?
- What methods are used for creating documents – pen/pencil, computer software?
- How many software programs are used? Which programs?
- Who is involved with which types of artifacts?
- How are files shared and how?
- What kinds of decisions are made? How are decisions made and who is involved?

- How do artifacts figure into decision-making process?
- What artifacts are kept?
- What artifacts are discarded?

I continued to code the transcripts, drawing connections between the statements of interviewees and the questions I sought to address. Listening to the audio recordings while I read and coded the transcripts was particularly useful for reflecting on my own position within the research.

METHODS FOR ANALYSIS AND INTERPRETATION OF DATA

The historical, reflective, and ethnographic methods I employed generated multiple kinds of data from various sources – professional and trade publications, archival documents, professional organizations, software programs, my research notes and interview transcriptions. To analyze the empirical data, I used Adele Clarke's situational analysis as a method of iteratively mapping the situation of inquiry. An extension of grounded theory, situational analysis was developed by Clarke to increase researchers' reflexivity, to incorporate discourse analysis, to engage non-human elements, and to move beyond action to focus on a full and complex situation. Clarke was building extensively on the work of:

- Anselm Strauss, particularly his interpretivist form of grounded theory and his social worlds/area theory, as well as incorporating;
- Foucault's emphasis on discourse;
- Actor-network theory from Latour and Law, and science and technology studies,

as well as;

- Donna Haraway's "situated knowledges" (Clarke, Friese, and Washburn 2015).

Adopting Clarke's situational analysis, I acknowledge my own situatedness in the research. I analyzed and interpreted architectural writing, technology, and practice from the perspective of an archivist/librarian/historian researcher. In addition to the published texts, transcriptions of interviews, and observed activities, I used my field notes as a significant source of data for analysis. I employed Clarke's situational maps as analytic exercises for thinking about the actors (both human and nonhuman), relationships, decisions, and situations present in the data. The iterative process of mapping, particularly using Clarke's situational and social worlds/arena maps, can provide a way of working through the data systematically (Clarke et al, 2015). Below is an early messy situational map that was useful for identifying the actors, both human and nonhuman elements in the situation. Throughout the research, I created maps – adding or revising elements as needed to identify actors, concepts, and social groups. The act of mapping or drawing actors and relationships based on what I learned gave structure to my early visualizing who, what, and how to address the complexity of the interactions.

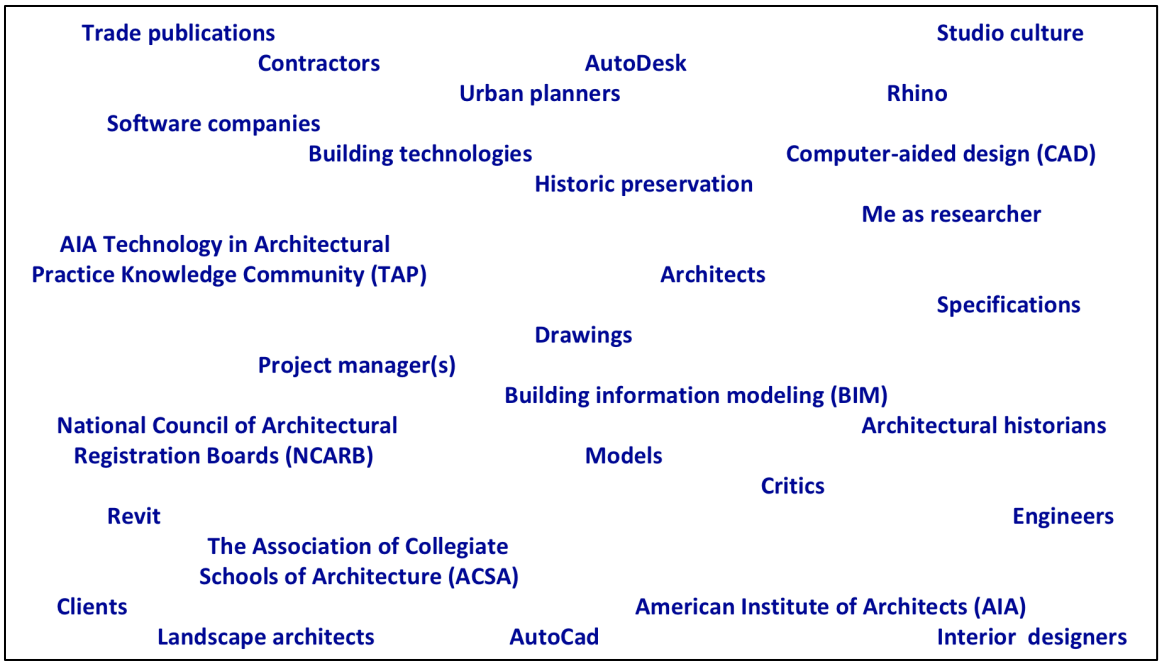

Figure 1: Messy situational map of social actors

Each of these maps serves as an artifact of my research practice in the process of becoming. The maps document what I was seeing, but also how I was seeing, analyzing, and making sense of the interactions I studied. They are not final, polished visualizations, but instead document my own messy practice of thinking through drawing and connecting ideas on paper. Maps served as reference points, reminders, and sites for specifying and abstraction. In several cases, I have added a secondary version of a map that serves to clarify the content, both visually and through additional textual description.

Focusing on making and doing is about looking at actions at work – at all of the various actors involved in architecture, archives, record keeping, and telling stories about architecture. I have come to focus on examining interactions because, in considering archives and architecture, there is a sense that they are always in process, incomplete,

uncertain. The question is: what stories can we tell about architecture that acknowledges the incompleteness, the uncertainty? How can dynamic artifacts tell stories? How can we build archives of value to reflect the interactions in practice? One key may be the shift to thinking in verbs instead of nouns – preserving, archiving, recordkeeping. As agents, we are always archiving, deciding what to keep and what to discard continually in the everyday negotiations in practice.

The overarching goal of my research project is to consider how to best document architectural practice. I am not seeking to determine a set of recommended artifacts that should be preserved. Instead, I recommend thinking more deeply about what architects do, what they make, and how preservation efforts can respond to the situated meaning of artifacts. Thus, Chapter 3 has described how I approached my research, how I collected and analyzed data, and how each of the methods employed addressed interactions between humans and artifacts.

In the remaining chapters, I will examine what I call the "architectural information system," a socio-technical construct that helps weave together the network of relations between people and artifacts, particularly in the introduction of computer technologies to architectural work. New ways of approaching complex work practices and studying the history of architecture can be understood through conceptualizing the collection of knowledge, experts, users in architectural work. I am particularly focused on the *architectural* information system but acknowledge that the boundaries can become blurry, particularly when it comes to what may be described as a "design information system" to extend beyond a focus on architecture (as both a profession and as a discipline), to related

fields. Indeed, drawing strict boundaries here is not my aim, but I am concerned with the specifics of *architecture* as part of a broad field in which there are shared terms, technologies, ways of working, and artifacts that have been developed over time. The *architectural information system*, as I identified in my research and describe in this dissertation, includes individual architects and collective groups of individuals working within firms, architectural education programs, trade and scholarly publications, software development companies focused on architectural technologies, professional organizations, regulatory bodies, libraries, archives, and museums that collect and provide access to architectural materials. I am focused on the *architectural information system* as a case to be examined within "building culture" where related fields will certainly intersect with architecture. In this dissertation, I will point to where my research reveals some of these intersections, as well as specific key aspects of architectural work that can help illuminate practice.

Chapter 4 addresses the development of technologies for architectural practice, with an emphasis on the multiplicity of perspectives on computer use in design and the dominance of specific tools within the industry. I engaged in learning two specific tools, reflecting on my own assumptions about these tools and increasing my understanding of technologies used in a specific architectural firm. Chapter 5 describes my engagement in the firm and answers specific questions about what these architects do, make, and value. Both of these chapters build on what we know about the architectural information system, which I will discuss in more detail in the final chapters.

Chapter 4: Investigating Architectural Technology[2]

Howard Davis' notion of "building culture" is useful for considering how architectural practice – the everyday activities that result in the built environment – is part of a larger context of institutions and people. “Building culture” encompasses social relationships among architects, builders, contractors, clients, occupants, real estate professionals, and manufacturers. It situates contemporary architectural practice as an historical extension of specific gradual changes in the ways that buildings are constructed, the ways that practitioners organize themselves into groups, and how they exchange information. Davis states that participants in building culture “are not only applying the knowledge contained in the building culture; they are also reproducing and perpetuating the culture itself” (Davis 1999, 107). Chapter 4 explores the diffusion of knowledge about computer-aided design and building information modeling in architectural practice, with a particular emphasis on the flow of information between influential theorists, firms, professional organizations, and software companies. It outlines key moments in the construction of an architectural information system.

The history of development and marketing of computer technologies for architectural practice can illuminate what information does, as an evoked concept, in the complex coordination of people and artifacts in designing and constructing buildings. Architecture developed as a profession through the creation of formal education programs,

[2] Chapter 4 contains edited and expanded material from the following published article:
Pierce Meyer, Katie. “Technology in Architectural Practice: Transforming Work with Information, 1960s - 1990s.” *Information & Culture* 51:2 (Spring 2016), 249-266.

licensing requirements, and legal responsibilities. As the role of the architect became differentiated from other members of the building culture – particularly builders, contractors, and engineers – documentation practices for architectural design changed (Mitchell 1999). Architects became responsible for communicating complex design ideas via drawings and specifications and for predicting building costs and schedules (Mitchell and McCullough 1995).

In modern architectural practice, the hierarchical structure of firms and specialization within various related fields of practice have created more formalized relationships between architect and client and between individuals within a firm. Furthermore, architectural documents became the official communication tool about a project (Lowell and Nelb 2006). Architects became responsible for gathering data, making design decisions, and communicating via artifacts (both digital and print). Architectural representations – the artifacts of practice – drawings, models, specifications, contracts, spreadsheets, writings, membership documentation, sketches, and notes, to name a few, make up the material culture of practice and information artifacts. Architects construct knowledge and communicate their expertise through such artifacts, which can tell stories about the architect's vision; the design iterations of the development team; working relationships among architects, clients and collaborators; and decisions made throughout the process of design and building. Architects are coordinators of complex projects, which means that they gather, store, synthesize, and share information in meaningful ways.

Architectural negotiation involves communicating design ideas and intentions through descriptive text and visual representations as a way of mediating between different

ways of thinking and perspectives. "Everything that an architect produces — conceptual sketches, physical models, functional diagrams, technical drawings, cost analysis spreadsheets, and verbal explanations — supports this process of negotiation" (Piotrowski 2001, 41). Artifacts produced in architectural practice can be viewed as "intermediary objects" that support the flow of information and give form to shared knowledge. (Boujut and Blanco 2003, 205-219). As such, they have communicative value in expressing architectural expertise. At the same time, as an architect takes on the role of coordinator in a building project as the producer and manager of these artifacts, the architect can exert control over information shared with other participants in the project to maintain authority (Cuff 1992).

In contrast to an architectural history of solo creators, this historical account will focus on the collaborative nature of work in architecture. Introducing computer technologies to architectural practice required work by many people within the information system. Architectural scholars conducted research on the capabilities for computers in design practice, introduced the benefits of changing practices, and contributed to the development and testing of programs. Practitioners and theorists debated and communicated the value of computer technologies for architecture. Key technological developments since the 1960s are worth exploring to determine the role of information in architecture. To focus this broad endeavor, this chapter examines three cases: research on computers in architecture in the 1960s, the development and dominance of AutoCAD in the 1980s, and the promise of building information modeling in the 1990s. The backdrop

to the discourse around technology for architectural practice is the discussion about increasing complexity in architectural projects.

In 1977, architectural theorist William Mitchell described the potential for computers to become part of everyday design practice in firms as due to three factors – theoretical advances in computer-aided design technology, architectural software development, and increased availability of hardware. In *Computer-Aided Architectural Design*, Mitchell predicted that developments in architecture and computer technology had reached the point that computer-aided design tools and techniques "will radically transform the practice of architecture" (Mitchell 1977, xi) The book was written as an introductory guide for students, architects, and computer technologists to bring together information about the developments in computer technology and the possible applications to architecture. Mitchell has been recognized because of his contributions to architectural education and design practice through his advocacy of computer use in architecture (Grimes 2010). He encouraged thinking about design as an "information processing task," through which one conceives of the mechanics of managing data – about a project, as well as related data (Mitchell 1977, 65). As an architectural educator and prolific writer, Mitchell was in a position to advocate for the use of computers in architectural work. By the time *Computer-Aided Architectural Design* was published, a significant amount of work had been done to bring computer-aided design technology to architecture. In the sections that follow, three cases will form one reading of the many narratives around architecture from the 1960s onward, illuminating how information, as a concept, was used

in conjunction with developing technology to address complexity within the industry and how these developments took place within a broad professional system.

Following the three cases, I insert myself into the historical narrative by reflecting on my own experience learning two software programs for architecture, AutoCAD and Revit.

RESEARCH AND THE DEVELOPMENT OF COMPUTER-AIDED DESIGN IN THE 1960S

One way to look at the early period in the development of computer-aided design technology in the 1960s is as an expansion of the information system through bringing resources from engineering and computer science to architecture, developing collaborative educational research teams to investigate how computers and designers can work together, and publishing for an audience that includes technology creators as well as architects.

Since the 1960s, new technologies for architectural practice have been created to produce, store, and share information. Programs have been used in architecture to aid designers in the act of drawing and modeling, to analyze and propose design solutions, to store design information, and to communicate design ideas (Kalay 2004). The first major computer technology that had ramifications for architecture, and for considering the role of information in architecture, is computer-aided design.

The use of computer-aided design applications in architecture trailed similar implementations within engineering and manufacturing. Stimulated by mandates from the U.S. Air Force in the 1950s, airplane engineers and manufacturers were early adopters and testers of computer technology for design. Computer-aided design, manufacturing tools,

and techniques were developed to use machines as a means of increasing precision and speed, while decreasing production costs. In the aerospace industry, automated drafting tools were widely used in the 1950s, and the needs of the manufacturers resulted in innovative software programs for project management, data collection, and engineering (Cortada 2004).

Research and development intensified in the academic community in the 1960s. Ivan Sutherland's 1963 electrical engineering doctoral dissertation "Sketchpad, a Man-Machine Graphical Communication System" and his development of the Sketchpad system are credited with being a significant contribution to computer graphics programming. (Mitchell 1977; Fallon 1998). Sutherland was working at MIT, along with Steven Coons, to rethink the interaction between humans and computers. Coons envisioned a Computer-Aided Design system that would allow multiple designers to interact with the system simultaneously, to communicate effectively with each other and "use the creative and imaginative powers of the man and the analytical and computational powers of the machine" (Coon 1964, R2-R7). While these researchers were approaching the problems from an engineering perspective, their work demonstrated possibilities for computer graphics that held promise for application to the architectural community.

By the mid-1960s, several conferences were organized to bring professionals together to discuss the possibilities and implications of using computers in architectural practice. "Architecture and the Computer" a Boston Architectural Center conference, was held on December 5, 1964, in Boston, Massachusetts. A total of 580 people, including 100 students, attended the day-long session. There were 14 presentations, a panel discussion,

two question and answer sessions, and demonstrations. The goals of the conference were to present information about current efforts in using computers in architecture and related fields and to open a discussion about the potential for computer use in creative design. (Boston Architectural Center 1964). The conference was encouraged by the American Institute of Architects, and financially supported by the Graham Foundation and IBM. In his forward to the conference proceedings, Boston Architectural Center conference committee chairman Sanford R. Greenfield reflected that the meeting functioned to "alert the profession to an irresistible force which will radically alter the practice of architecture whether we plan for it or not." He acknowledged the extensive use of computers in related fields, such as engineering (structural and mechanical), construction, and planning. The goal of the conference was to inform participants about computer uses in associated fields and to initiate discussion about potential use in the creative process. Greenfield's forward in the conference proceedings situated the architect within an information system with other professionals, wherein the computer is becoming part of professional practice and it benefits practitioners to examine the role of the architect in light of technological developments.

Writings on the complexity of the design process and changing social needs in conjunction with new technologies suggested that computers assist architects, designers, and planners with their role as socially responsible professionals. The introduction of "Design and the Computer," a double issue of *Design Quarterly* published in 1966, opens with the assumption that there is a need for information about technological developments specifically for designers. Editor Peter Seitz identified that the airplane and automobile

industries led the development of computer-aided design. Seitz called for design professionals to learn new computer tools to experiment with design ideas:

> The computer not only assists the designer in his manual tasks, but because of the tremendous command of information made possible by the computer, it also enables him to process almost endless facts and figures, organize this complex data and analyze the requirements and interactions of any design problem (Seitz 1966, 3).

The articles in the "Design and the Computer" issue focused on specific applications of computer technology for design fields, including one by Steven Coons on Computer-Aided Design. Coons described human and computer contributions to the design process, the original Sketchpad system, and Sketchpad 3 – which could be used to create complex three-dimensional images (Coons 1966, 7-13).

In 1968, Yale held a conference on Computer Graphics in Architecture. Approximately 300 attendees gathered for 14 presentations and two panel discussions. The aim was to present research on computer graphics to design professionals, directly from those involved in development projects in architecture, planning, simulation, urban design, and environmental ecology (Milne 1969). The Yale conference is another example of bringing architecture and related fields into conversation about computer technologies. In the preface to the conference proceedings, architect and professor Murray Milne stated that there is a desire by some within the industry for architects to "expand the methodological repertoire and increase the amount of information – the software – that the designer can bring to bear on a given problem" (Milne 1969, preface). The conference was designed to communicate information from researchers to practitioners, suggesting that the flow of

information about computer graphics for architecture involves teaching architects to be comfortable with the role(s) computer technology can play in their practice.

In 1970, Nicholas Negroponte wrote: "Census data, site descriptions, transportation statistics, activity constraints, economic criteria, and material specifications are all part of the bulky dossier of design information necessary for any urban design project. The information burden is fantastic" (Negroponte 1970, 51). As part of the Architecture Machine Group at MIT, Negroponte was working to move beyond just finding ways to automate limited elements of architectural work to create "intelligent machines" that can be partners in architectural design. Negroponte and Leon Groisser founded the Architecture Machine Group in 1967 to bring together researchers in architecture, engineering, and computing. Negroponte was, in part, arguing that a central role of an architect or designer is to deal with missing information and face uncertainty, and machines for architecture should be designed to handle these same conditions – or at least acknowledge that these are the conditions in which they will work. Negroponte was looking beyond the everyday uses for computer technology that had been presented within the information system to scope out where computer technology and architecture could co-develop, even in this early period when computer-aided design was not yet accepted as part of everyday architectural work.

William Mitchell cited three key reasons that computer-aided design was adopted slowly in architecture firms: "hostility" from architects, "ignorance of the potentials of computer technology," and financial constraints of relatively small firms (Mitchell 1977, 15). He notes that the economic challenges are particularly great, as compared to other

fields where computer-aided design was implemented more readily, specifically automotive and aerospace engineering. One key point to be made here is that the relatively small size of architecture firms and the economic investment necessary to introduce computer-aided design to such firms meant that the adoption of the technology needed to be perceived as necessary or valuable to the industry – not just to individual practitioners or firms. But a further examination of the economics of adopting computer technologies is beyond the scope of this study. Mitchell presented computer-aided design as a "technologically and economically feasible reality" to a specific audience of architecture students, practicing architects, and computer technologists. (Mitchell 1977, xi). His aim, it would appear, was to counteract hostility and ignorance by showing the value of computer aided-design and to predict that the changes in computer technologies were going to allow for increased availability to computers and programs to firms and therefore changes to practice.

Many of the sources discussed above indicate an apprehension on the part of some architects about embracing computer technology within their practice because of uncertainty about the value of the technology and concerns about potentially changing the role and status of the architect. A common theme in the conferences and industry publications on technologies during this time focused on educating practitioners about computers and addressing the role of the architect. There are common assumptions at play in the flow of information from researchers and advocates to practitioners:

> 1. Computing power could address specific needs of the architectural community – needs based on the difficulty of managing complex information, particularly information presented in graphics such as architectural drawings and models.

2. Apprehension or hostility towards computer-aided design can be tempered by exposure to the capabilities of computers and attention to preserving, or extending, the role of an architect.

Looking back at computer technology development for the industry from the 1990s, Kristine Fallon, a consultant who has published extensively on architecture and computer technology, supplies an historical perspective on computer-aided design within architectural practice:

> From the first computer graphics explorations in the 1950s through the 1970s, there had been a very open-ended exploration of how computers might be used in design practice, with architects and engineers involved in building software tools in a very hands-on fashion. In the 1980s, the baton was passed to the vendor community, and design professionals became consumers of software products (Fallon 1998, 26).

In the 1960s and 1970s, several firms in the United States developed their own software programs. But by the 1980s, even early pioneers of architectural technology were turning to the commercial market after finding that the commercially available solutions to their needs were better than those they could produce in-house (O'Brien 1984).

THE RISE OF AUTOCAD IN THE 1980S

In the early to mid-1980s, architectural firms began adopting computer-aided design (CAD) technologies, in large part because the development and affordability of computers occurred in concert with the years of research and discussion in the industry. Early commercial CAD programs responded to the perceived need for drafting and modeling software (Kalay 2004). CAD systems allowed architects to create 2-D drawings and 3-D models, to store and reuse a library of design applications, and to produce proposals and presentations. In the 1980s, numerous companies competed to create and

sell CAD software to firms, including AutoDESK, Intergraph, Bentley Systems, Palette Systems, and Dassault Systèmes, to name a few.

The editors of *Architectural Technology*, a publication of the American Institute of Architects, organized two rounds of CAD evaluations ("shoot-outs") and published the results in 1984 and 1986. In the 1984 shoot-out, 14 architects evaluated six programs. In 1986, 22 architects evaluated 11 programs. By the 1984 review, AutoCAD was already acknowledged "the de facto standard for affordable CAD" and the most popular with 5,000 licenses sold. (Allsopp, Kowall, and Voosen 1984, 51). In the first round, only one of the programs was 3-D, but, by 1986, "most of the programs are expanding into 3-D," giving users the ability to create 2-D plans, elevations, and construction documents, as well as 3-D models of buildings (Witte 1986, 30). The shoot-outs revealed that there were many affordable options for CAD software in the mid-1980s. While none was a clear winner in terms of functionality, AutoCAD was already a strong program that worked well with a range of hardware options, was customizable, and had excellent support – including training centers, publications, and user groups (Witte 1986, 30).

From the 1980s through the 1990s, there was substantial competition between CAD developers, with AutoCAD becoming the predominant tool within the architectural community by the 1990s. According to the 1991 AIA Firm Survey, "no other CAD software approaches the level of the use of AutoCAD in architecture firms," during a time when roughly half of all firms used CAD (American Institute of Architects 1991, 72). Survey data indicate that 85% of design firms had AutoCAD licenses, although many used other CAD programs (Fallon 1998). So, how did Autodesk, the company that created and

distributed AutoCAD, manage to sell their product to such a large portion of the architectural market?

John Walker, co-founder of the computer-aided design software company Autodesk, described an approach to marketing MicroStation, the original name of AutoCAD, on April 28, 1982:

> We can probably obtain substantial free publicity by issuing press releases and writing articles stressing the tie-in with computer aided design and the IBM robot controlled by the IBM personal computer. We can also aim our ads to sell the product as a "word processor for drawings." Potential customers are anybody who currently produces drawings. Small architectural offices are ideal prospects. (Walker 1982)

By May 1985, Autodesk began using targeted mass marketing and public relations efforts to continue to build the market for their product. The company looked specifically at publications targeted to get information to professionals in firms: trade magazines, books, and tutorials on the software. Additionally, they actively pursued educators as a way to introduce the next generation of practitioners to their software:

> Autodesk supports its advertising with an aggressive public relations effort, combined with an ongoing program of seeking and arranging for the publication of articles in the trade press describing applications of AutoCAD in various industries. Autodesk makes a major ongoing effort to communicate with industry analysts and key decision makers, seeking to demonstrate the benefits of AutoCAD versus larger systems. Autodesk supports the development of tutorial materials and books based on AutoCAD. Finally, Autodesk has a major commitment to the educational market, offering support and incentives to institutions wishing to teach CAD, and encouraging the adoption of AutoCAD in their curricula. (Walker 1985)

Through this targeted approach to marketing the software, Autodesk was actively taking advantage of the established architectural information system.

Kristine Fallon attributes some of the success of AutoCAD to early development choices made, specifically the ability to create an "entity interchange format" file (1998). As indicated in the "AutoCAD-80 Development Log" in *The Autodesk File*, the decision was made in the summer of 1982 – all versions would have this utility, initially with the file extension .eif (Entity Interchange Files), but quickly changed to .dif (Drawing Interchange Files) (Walker 1982). The file extension would eventually become .dxf. Drawing Interchange Format (DXF) files enable the interchange of drawings between AutoCAD and other programs. AutoCAD developers decided early on to make sure that drawings created in AutoCAD would enable data interoperability in a way that allows information to be shared.

Ken Sanders, an architect and chair of the AIA's National Computer-Aided Design Practice Professional Interest Group in 1995, stated, "CAD is best understood as a design information management system. It is a tool with which architects can develop full-size graphic descriptions of buildings, and share, reuse, and republish that information in a variety of formats" (1996, 248). Specifically, Sanders was pointing to reusing information in multiple ways: for different projects, to communicate with clients, and to share with colleagues in related disciplines. Sanders is providing a practical framework for architects to think about the value of information in design and the ways that computer-aided design technology might be best used to manage information for complex coordination of a design project. He was also demonstrating the information system of architecture by pointing to the ways that information needs to be shared beyond the firm with clients, engineers, and interior designers. AutoCAD was widely adopted for several reasons. AutoDesk responded

to the need for architects to share information, developed software that would be interoperable, and employed marketing strategies that used existing information networks.

THE PROMISE OF BUILDING INFORMATION MODELING (BIM)

In 1975, Charles Eastman described the role of information in architectural representations.

> Drawings are an integral part of architectural practice. They are the principal medium for design and coordination and for communication with the client and contractor… The primary use of drawings in building is to depict the spatial composition of materials and spaces. Ancillary information regarding materials and spaces can be provided through notes and tables appended to drawings. In this light, drawings have no intrinsic value in architecture, but are only the most useful existing device for the representation of building spatial information in a form that is convenient for decision-making.… Models, like drawings, incorporate spatial information in an easily interpreted form.… A model can represent all three dimensions of a composition directly, which a drawing can represent only two [dimensions] unambiguously. Thus it takes two drawings to represent the information provided by a single model (46).

While Eastman identified these two graphic forms as central to architectural work, he also indicated the need for additional information to be collected and communicated along with drawings and models. His model of a conceptual "building description system" identified the possibility for developing a computer program that could create a unified building representation based on defining the building's information elements.

In 1999, Eastman declared that information technology would bring about significant changes in the building industry, which he defined as "architecture, civil engineering, and construction." (3). These changes, according to Eastman, were due to increased availability of software and the ability to share large amounts of information

rapidly. Within the building industry "the problems of data exchange and integration" were still challenging, despite the industry adoption of computer-aided design technology.

The next stage of computer technology for architects to embrace was building information modeling (BIM):

> BIMs can be defined as digital models intended to integrate a lot of different information about a given construction project – e.g. geometrical properties, visual properties, functional properties, production-related properties and product-related properties. BIM is not a technology as such. Rather, it denotes a process of assembling information, obtained via different kinds of technological solutions. (Plesner and Horst 2013, 1122).

Using a variety of building information modeling software programs, professionals in the building culture could work collaboratively to develop three-dimensional, dynamic building simulations that increase integration and automation throughout the lifecycle of a building project:

> A building information model is a repository for digital, three-dimensional information, and data generated by the design process and simulations—it's the design, fabrication information, erection instructions, and project management logistics in one database. The data model will exist for the life of a building and can be used to manage the client's asset. (Shinnerer & Co. 2007)

The changes to architectural practice include increased sharing of data throughout the process of design and construction with a variety of stakeholders or members of building culture. "BIM programs allow architects, engineers, contractors, owners, and others to access documents simultaneously. Participants can generally access and format information as best fits their particular field." (Hoekstra 2003, 79-81). BIM is an attempt to create an information infrastructure through computer technology – to connect the relevant members of building culture to the information about a specific architectural project.

Figure 2 is a messy map that identifies several different uses of BIM, as identified through reading AIA surveys and gathered during my engagement in the firm. It specifies collective human elements (clients, contractors, consultants) and begins to make connections between types of activities and uses of BIM. As an artifact of my own research practice, it shows my thinking in process as I began to explore the many articulated uses of BIM.

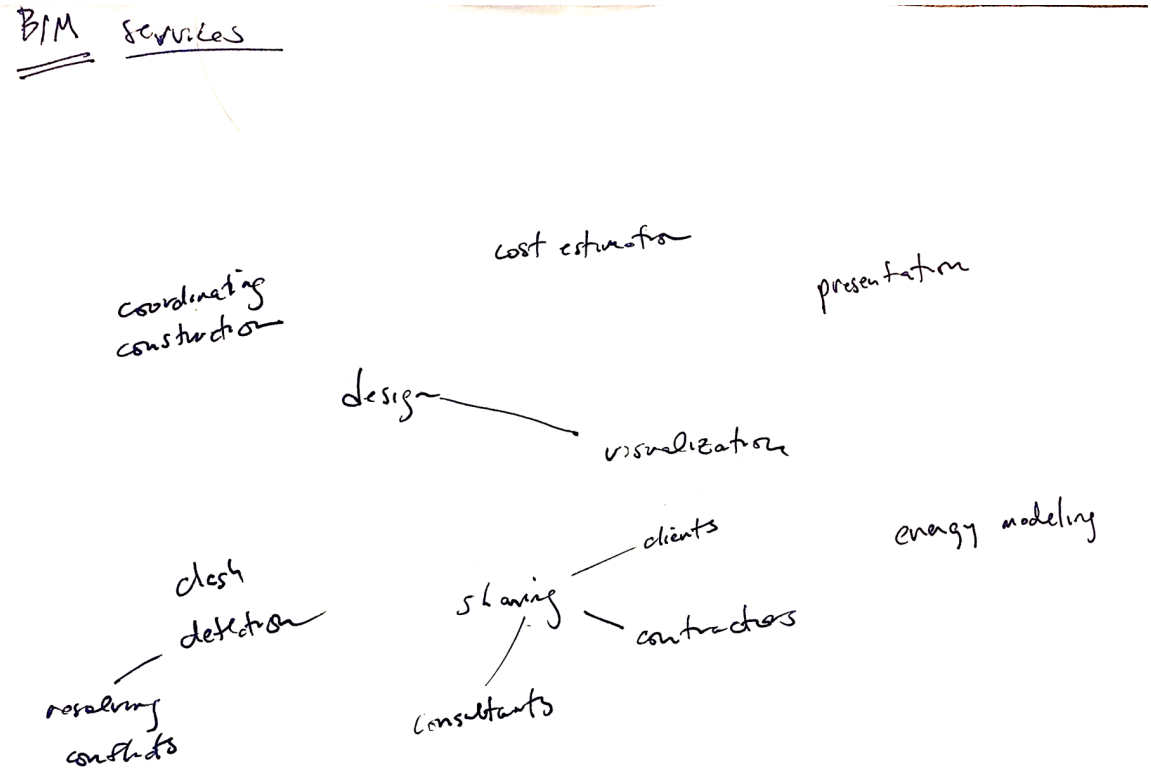

Figure 2. BIM Services

Figure 3 below is a revision of Figure 2 that specifies what I see as three primary functions of BIM – design, sharing, and coordinating construction. The collective human actors are identified in blue text and connected by lines to the primary functions and other uses for BIM. Energy modeling is still present as a use for BIM, but not one that has

articulated relations to actors or other functions, since it was not clearly expressed in what I read or saw in my engagement as an active use at present.

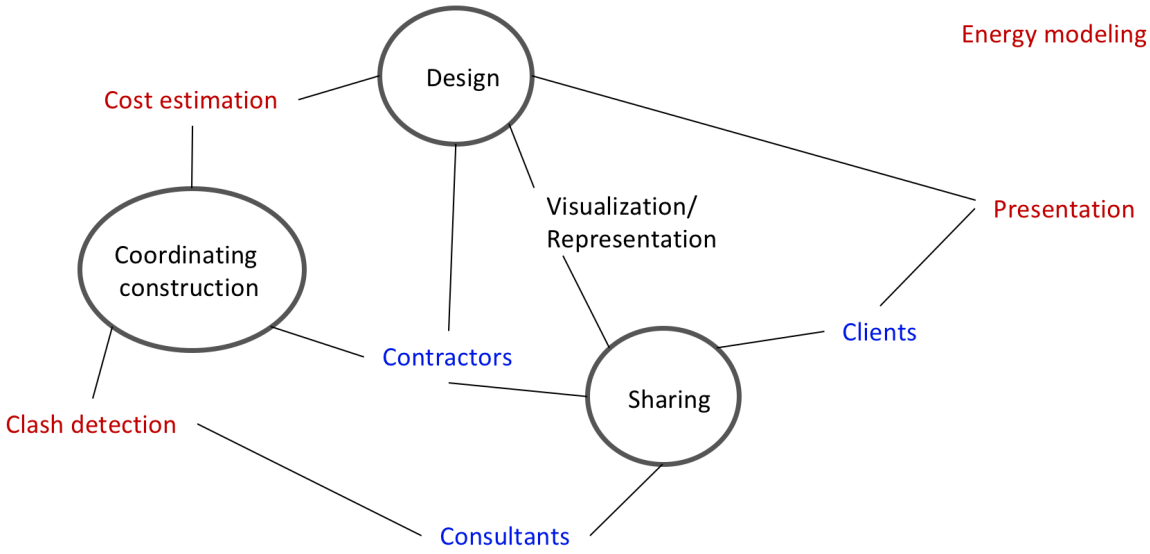

Figure 3. BIM Services – secondary version

Figure 3 is a relational map version of Figure 2, wherin I worked out relations between elements, in this case trying to connect who is involved in which uses of BIM technology. Additional collective human actors, political and economic elements, temporal elements and relevant discourses could be added to this map, but will explored further in the text.

In 2005, Phillip Bernstein, the vice president of the building industry division of Autodesk described BIM as "moving from traditional ways of doing business into fully collaborative, highly integrated, and productive teams that include all the stakeholders in a project's lifecycle. It's a vision of a building process where information flows freely and

can be used where it is most needed." (Bernstein 2005). The promise of BIM is one based on the assumption that sharing information in a digital form with many participants in the process of design and construction of a building adds value. But often it is not the architect making this determination. "Policy-makers and other actors have pushed for the use of technical standards and shared digital models among architects, contractors and others involved in planning and building, in order to eliminate misinformation and ensuing economic losses." (Plesner and Horst 2013, 1121). Returning to the early concerns many architects had about computer technology in architectural practice, this particular shift has implications for the role of the architect in building culture.

The flow of information in the development of an architectural project shifts with the use of BIM, changing the way stakeholders communicate during planning and design:

> The predigital design process would be a gradual accumulation of information, starting slowly and picking up more and more speed. By comparison, the introduction of 3-D digital modeling very early on in a project has created the exact opposite situation. Since the model has to contain all information relevant not only to architects but also to non-architect actors, a huge bulk of information must be assembled early on to be gradually refined. (Plesner and Horst 2013, 1122).

BIM technologies serve as a mechanism for organizing information about a project, but can also shift expectations about what information an architect has and at what point in the design process.

Building information modeling can be viewed as the historical extension of early theorizing on computers within architectural practice. The promise of BIM centers on using computer technology for two main reasons:

- To provide order to the messiness of practice by centralizing information regarding a building project, and

- To facilitate sharing information with collaborators within building culture.

The artifacts of architectural practice – the sketches, drawings, models, spreadsheets, and correspondence – are the tangible traces that make the field of work, the information infrastructure of building culture, visible.

EVOLVING CONCEPT OF INFORMATION IN ARCHITECTURAL PRACTICE

The underlying assumption of the theorists and practitioners presented in this historical account is that the design and construction of buildings is a collaborative activity. The technologies that have been actively developed and used since the 1960s are designed to share information and to facilitate the coordination of multiple people working within building culture. These technologies are part of the information system, just as they were created in response to the need for digital infrastructure to support work within the industry. The shifting way that information, as concept, is employed in conjunction with architectural technology is worth investigating in terms of the role of an architect. Early discussion about digital technology centered around using computers to manage the complexity of the work – gathering information, storing information, sharing information. With the turn towards BIM, there is new emphasis on controlling the flow of information and on asserting authority within a building project.

The iterative nature of architectural work and continual changes over the course of a project mean many, if not all, decisions are open to negotiation within a complex social configuration. Dana Cuff claims "as experts, architects can open and close lines of inquiry with their authority and knowledge of the process" (1992, 93). What exactly is this

expertise? What does expert architectural knowledge entail? How does collaborating and sharing information using various technologies restrict or highlight architectural expertise? Much of the aversion to adopting computer technologies for architecture in the 1960s and 1970s stemmed from a concern for maintaining the perceived authority of the architect. How has adoption of computer technologies changed the role of the architect? One could argue that it hasn't. Some of the knowledge required to practice architecture has changed, and the form of presenting information certainly has, but the architect is still the coordinator of complex projects.

One way that architects represent and communicate their knowledge is through artifacts they have created, shared, or manipulated – increasingly using computer technologies such as those described in this chapter. Managing the complexity of information in architectural artifacts while clearly articulating design intention is one way architects demonstrate expertise. It is worth noting that much of the technology developed since the 1960s was designed to help manage and communicate information about architectural projects more effectively, particularly to others within the building culture. Nicholas Negroponte called for architects to partner with researchers in engineering and computing to design machines that could confront uncertainty. William Mitchell presented the value of computer-aided design in managing information in increasingly complex building projects. The development of CAD systems initially allowed for relative ease in creating and reproducing 2-D drawings of buildings, but the technology was rapidly revised to include additional functionality for distributing data about projects, through 3-D models and databases of information. BIM is yet another example of technology applied to

architectural practice, specifically designed to share and control information beyond a firm – with architectural collaborators, engineers, contractors, and clients. The key is locating the architectural expertise within this complex information system. Technological changes since the 1960s haven't necessarily widened building culture, but examining the making of the artifacts of these new information practices may make the existing architectural information system more visible.

REFLECTION: LEARNING ARCHITECTURAL TECHNOLOGY

In Fall 2015 I participated in two week-long training opportunities to learn two specific architectural software programs: AutoCAD and Revit. The courses were in the Architectural & Engineering Computer Aided Design (CAD) Training Center at Austin Community College (ACC), a registered continuing education provider for the American Institute of Architects. There were two primary goals for me to engage in the courses:

- Learn the terminology and activities involved with using the software, which would help me construct questions to ask informants in the field;
- Learn how to use these tools (in some way), as a way of embodying some of the knowledge of what my informants do.

Additionally, I found that the experience allowed me to put into practice some of the knowledge I have developed in my research thus far, and to test some of the assumptions I have about the software.

Both courses consisted of forty hours of class instruction, each taking place over five days, Monday – Friday. The same instructor taught the classes I attended, and there

was one student besides myself in each class. I took the AutoCAD Essentials course in October, assuming that it was the fundamental course in architectural technology. The other student in the class was an interior designer who had worked successfully in her field, designing high-end custom homes. She was familiar with AutoCAD, but felt that so much had changed since she was in school thirteen years before that she needed additional training to facilitate a career transition. Given her desire to go back to graduate school and teach interior design, the course was a way to refresh her knowledge of architectural software. She also planned to take the Revit Essentials course as well, but a job opportunity prevented her from attending the second course I took in November. In the Revit Essentials course I had one fellow student, an architect who primarily uses AutoCAD in her work. Her husband and business partner primarily uses Sketchup or Rhino. She is aiming to simplify their workflow by learning Revit, in hopes that they will not have to go back and forth between various programs. Both classmates had professional experience, were trained as designers, and were more familiar than I was with not only the technology but specific objectives for using the technology in their work.

While I didn't have "designerly" experience informing my learning, I did bring my archival expertise, research experience in architectural history, knowledge of the development of these programs, and various assumptions I had developed along the way. So, what did I know going in? Autodesk owns both AutoCAD and Revit, but Revit was more recently acquired in 2002. AutoCAD was developed, marketed, and released by AutoDesk in 1982. AutoCAD has been leader in the industry for years, notably since the mid-1980s, somewhat due to educational efforts such as offering training programs. There

are frequent version releases of both programs, which are expensive and challenging to keep up with in practice. AutoCAD is one computer-aided design program specifically for architectural work, especially the creation of architectural drawings (both 2D and 3D). There are many other CAD software programs, but AutoCAD is dominant. Revit is a building information modeling or BIM software program. It allows one to gather and embed information into a model, which can be used throughout the lifecycle of a building, beyond design and construction to maintaining a building. The software is designed to allow multiple collaborators to work on one BIM.

In addition to knowledge I have gained through examining the development of these tools, I also have assumptions about both programs, based on my own experience and on anecdotal evidence from conversations I have had with various architecture students. One primary assumption is that Revit will be easier and more fun to use than AutoCAD. From my experience, AutoCAD is technically challenging. I had done some work in AutoCAD years before and found it difficult to learn quickly. The program felt powerful and extremely capable of allowing one to create complex drawings. My challenge years ago was that I had only a few days to quickly complete a few simple drawings. The AutoCAD Essentials course gave me an opportunity to devote time to learning the program, instead of simply trying enough to accomplish a task.

On the first day of AutoCAD Essentials in October, the instructor presented the idea that "you can only learn by drawing." It reminded me that, in my experience, learning involves active doing – the more I drew, the better I got at understanding how to draw. Some of my comfort was based on simply remembering shortcuts and understanding how

to manipulate the tools to achieve what I want, but some of it involves thinking through drawing – feeling inspired or confident to create lines or shapes. The files that we used and produced over the week-long class were, along with the books, intended to be learning tools so that we could continue to build our knowledge. AutoCAD is a database made up of instructions and data – connected by calculations. The program is versatile – users can determine a new set of preferences to change, which allows for a lot of customization, which can be overwhelming. It also means that one can rely on default settings, which have defining implications for the artifacts produced. Templates can be created that contain information, such as the units, styles, and layers in a project. Layers provide a way to organize elements in a drawing. For instance, one layer can contain walls, another furniture, plumbing, etc. Layers can be turned on or off, frozen or thawed, locked or unlocked – all of which have implications for how the data contained in that layer are viewed, modified, and related to other objects in the drawing. The application of applying appropriate metadata is important when naming layers, particularly when collaborating with others.

In software, the ribbon across the top is an organization of tools in AutoCAD. It very much mimics / relates to / draws on Microsoft Office/Excel in terms of look and feel, making navigation feel familiar and increasing ease of use, since I am comfortable using Microsoft Word. Also, AutoCAD reminds me of Photoshop. As with Photoshop, I continually feel that I am just scratching the surface of what can be done in AutoCAD and that there are probably easier ways of accomplishing tasks than those I use – as was proven later in my course experience when one of the students finds, learns, discovers shortcuts while I slowly follow directions. In AutoCAD, some functionality is hidden, others on by

default. As I mentioned, the program is highly customizable. It feels as if there is a long learning curve and I began to experience concerns about setting up a workspace in ways that are problematic or limiting. I felt that the ways I set up a project would constrain what I could do later. Questions: How much choice is made in practice about setting up a workspace? How much consensus among collaborators is there about tools? Does it matter? How does one become "expert?" Time? Trial and error? On the second day, I found that, as long as I move through exercises slowly, taking my time, I remember what I learned and feel comfortable. I can't compete with my classmate, who found another way to go through the exercise, while I followed steps. AutoCAD felt very command heavy, as if I were learning a new language, and specifically learning the shortcuts to commands, in addition to the commands and what they accomplished**.** We were encouraged to look to the command line to see what it expects, which was useful once I understood both what I was trying to do and what command would be appropriate. I also found that there are multiple ways to execute commands. I can definitely see how skill development is dependent on frequent use and having opportunities to "play" with the software to discover multiple ways of working.

Within two hours on the first day we got into a discussion about hand drawing, about using drawing to work out solutions, and about knowing how to solve a math problem as opposed to relying on a computer to work out the answer. The instructor presented this reliance as a distinction to be made between AutoCAD and Revit. I think this distinction reveals an assumption about AutoCAD and Revit that I want to continue to probe: Perhaps Revit feels easier or more intuitive, but is it is because Revit is doing the

calculations? With AutoCAD, one must make decisions and explicitly tell the software how to treat elements. The instructor noted that with Revit, one must understand how the software behaves to get it to do what one wants and that Revit reveals itself with use. That last statement implied to me that there are a lot of things Revit does that are concealed if one does not know how to look. For instance, walls are automatically joined in Revit (unless one disallows it). In AutoCAD, one must make specific choices to join walls.

In AutoCAD, my instructor had to continually remind me to zoom in to make precise choices, to change things, connect things, such as joining walls. I have a tendency to want to zoom out to see the whole drawing. I felt the continual struggle throughout the training to understand the whole of things – the full drawing, the goal of the assignment, where I (my cursor) was situated within a project. Perhaps I wanted to know what the finished product would look like so that I could work my way toward it, as opposed to letting it develop over time. Or maybe I just wanted to keep the big picture in mind while simultaneously diving into the details of a design. Learning Revit, I noted that I was beginning to understand the architect God complex a bit, the feeling of drawing something and simultaneously imagining it as built in the world. Revit calculates much of what is manual and tedious in AutoCAD. There is a lot of information embedded in files in Revit – the key is to determine how to add, edit, and modify the information, as well as understanding the relationships between data stored in various places within the BIM.

Many large questions remain, especially regarding collaborating with others using AutoCAD and Revit. These questions include:

- What are implications of frequent version releases? How well do they interoperate with earlier versions?
- Who owns the BIM while the project is in process? Who owns the BIM after the project is completed? Who is responsible for the BIM? Who can use it, modify it?

On July 7, 2016, I had an opportunity to revisit my learning experience with AutoCAD. I opened AutoCAD in the UT Libraries Scholars Common Data Lab and was initially overwhelmed by the complexity of the software. Slowly I remembered some basic tools, and I drew a circle, then a line, then added dimensions to the line. Once again, as long as I took my time, I began to recall basics and started playing. I zoomed in and got lost. I could not see my lines and could not zoom out with mouse. I again faced my desire to see the whole of what I had done. Then I remembered command line: Z (zoom), E (extents), which were commands I used frequently during my class. ESC key is my savior – I found myself needing to back up, back out of commands. My experience learning AutoCAD and Revit can be characterized by continually trying, creating something, getting lost, backing up, regaining my sense of the big picture, and then trying again. It feels like a technology-mediated version of Schön's reflective practice and designerly ways of knowing.

CONCLUSION

In Chapter 4, I have provided a historical account of the development of architectural technology within a complex information system and inserted myself into the narrative by describing my own experience learning two specific software programs that are widely used in practice, including the firm where I conduct my fieldwork. Using

Howard Davis' "building culture" as a frame, I have described the development of architectural technology within the context of collaborative activity, from the early theorizing and debates about the role of computers in design to the marketing and deployment of software. In this story, architects are coordinators of complex projects within building culture and artifacts take on roles related to sharing, managing, and controlling information. In this dissertation, I seek to explicate how artifacts are made, shared, and kept in the context of architectural production. This chapter has served to set what I find about current practice into a history of technology development choices within the industry, as well as by individuals and firms who choose to use specific technologies in their work. In my experiences learning AutoCAD and Revit, I confronted decision-making in technology-mediated contexts and gained an understanding of the differences between the two programs. I gained an increased understanding of the complexity of these programs, the affordances and limitations of each, and a "language of designing," to borrow from Schön, that I can then took back into my re-engagement in the firm. In Chapter 5, I will focus on what I learned through that engagement in one situated context.

Chapter 5: Engagement in the field[3]

INTRODUCTION TO THE FIRM

Jackson Architects[4] is a multidisciplinary architecture and engineering firm headquartered in the southern United States. The firm consists of multiple offices in the United States, which were opened as the firm expanded since its founding at the end of the 19th century. My fieldwork was conducted at one of the offices in the originating location. My involvement with Jackson Architects began through conversations with a faculty member about my research, who helped initiate contact with the firm initially in 2010 and again in 2016. The firm maintains strong connections to universities. Several architects at the firm teach, and some staff members at the firm studied under the lead designer. The firm's active involvement with academia served my project well. It both facilitated my access to the participants and provided a context wherein individuals are open to research inquiry about their practices.

This chapter focuses on what I learned through two periods of engagement at the firm: my pilot study conducted in 2010 and my dissertation field work, conducted in 2016. I will briefly describe key findings from the pilot in the next two sections, then expand on what I found on returning to the firm six years later. As described in Chapter 3, the pilot study informed my understanding of the everyday work in architecture as well as my methods for gathering, analyzing, and interpreting data. The following visualizations demonstrate ways I tried to interpret the interactions of people and artifacts and how I

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[3] Chapter 5 contains edited and expanded material from the following published article:
Pierce, Kathryn. "Collaborative Efforts to Preserve Born-Digital Architectural Records: A Case Study Documenting Present-Day Practice." *Art Documentation* 30:2 (Fall 2011): 43-48.

[4] Jackson Architects is a pseudonym.

applied methods from Clarke's situational analysis to revisit, reinterpret, and revise my early visualizations.

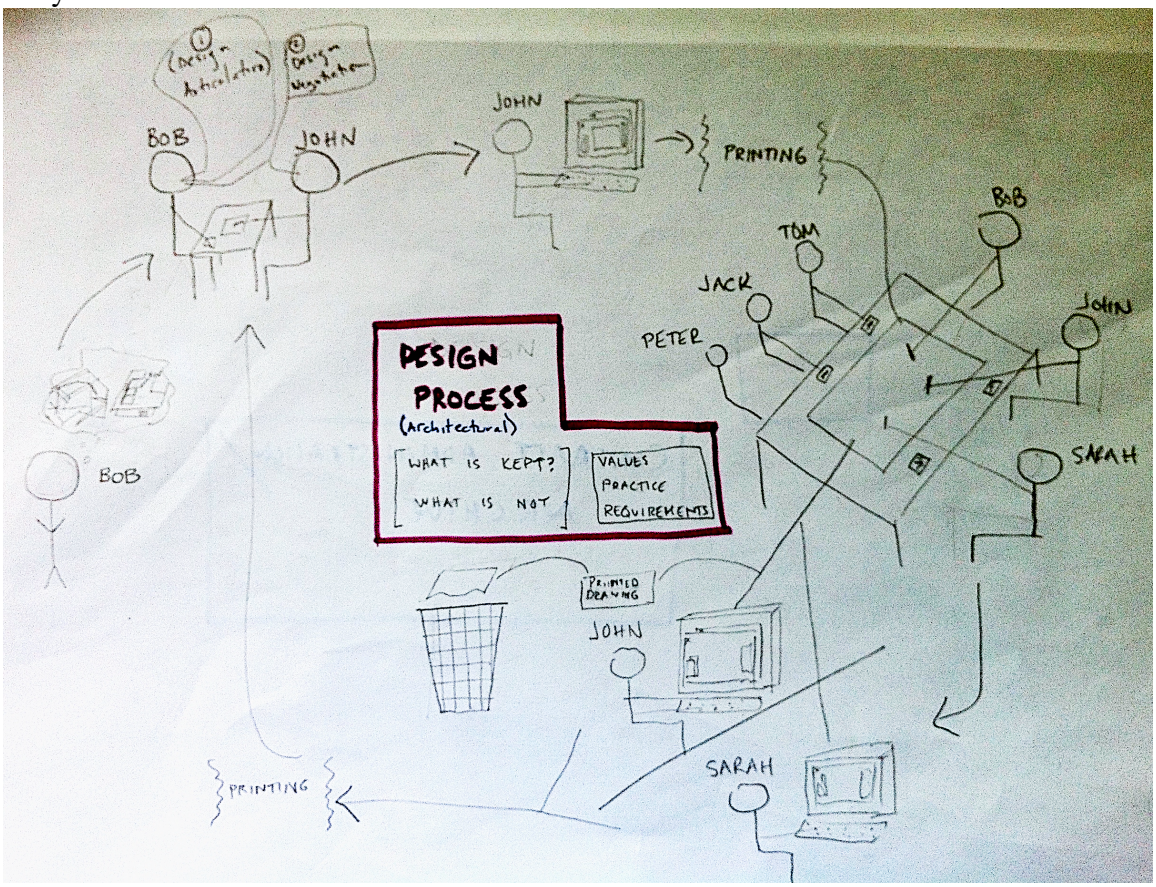

Figure 4. Visualization of the design process

Figure 4 illustrates interactions I saw in the firm, specifically the articulation of ideas from the lead designer to the senior associate and the design team. I also wanted to identify where computer technologies were employed in the process and where paper artifacts were employed in the design process. This visualization illustrates what I saw and heard about how individuals and artifacts interacted and how artifacts were created, used, kept and discarded. Figures seated around a table represent the project team meeting I

described previously, wherein multiple team members actively contribute to design changes by sketching on a printed drawing. While I initially focused on the printed drawing and the subsequent destruction of the artifact after changes were made in AutoCAD, the collaboration between the project team and the way drawings and technologies were integrated into their work became paramount. I was beginning to see architectural design in the firm as a series of negotiations, wherein artifacts play a role of helping to articulate ideas and become a shared space for communicating design changes. In Figure 5, a revision to the original that clarifies the activities, we can see individual work, collaborative work, and negotiations identified. Re-drawing this visualization serves as an act to clarify both the visual representation of the activities and as an interpretative iteration. Figure 5 minimized the people a bit, in favor of focusing on the activities and points and types of interactions.

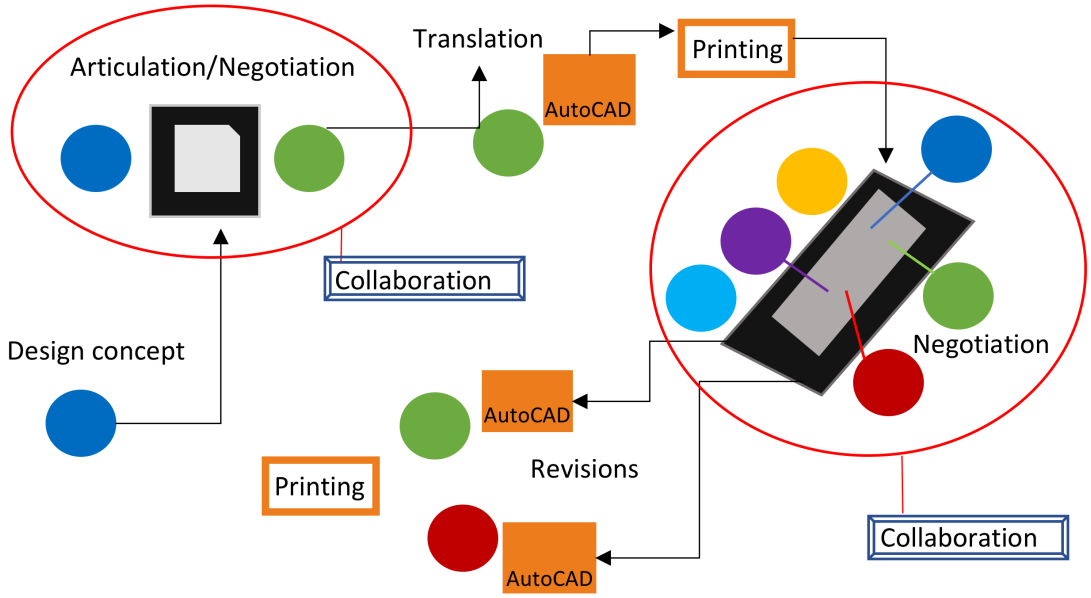

Figure 5. Revised design process visualization

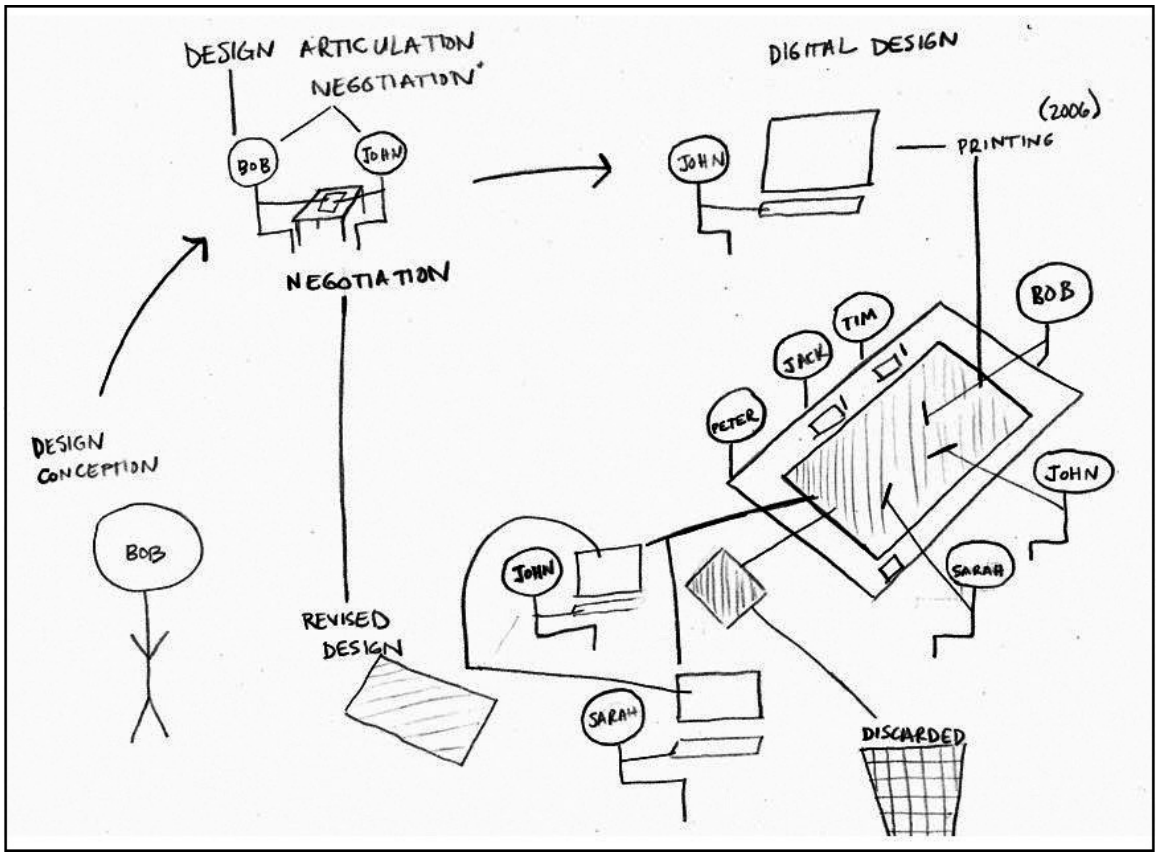

Figure 6. Following the artifacts and the people

But the initial drawing I made specified the people in a way that is telling – especially at the point in my research where I was shifting my focus from the technologies and artifacts to include the people. Drawing and redrawing have provided a way of remembering, analyzing, and pushing myself to consider what and how I was seeing. Figure 6 more clearly shows my work to follow a process, in this case a single design in the process of becoming, from the initial design conception through various interactions with people. Multiple single artifacts were produced throughout this process and this drawing demonstrates my way of recalling and placing the people and artifacts in spatial contexts – meeting around a conference table, over a printed drawing, working individually

at a computer. Following the artifacts and the people and seeing these points of interaction and of individual work demonstrated the value of iterations in the design process. This way of drawing, identifying points of discarding drawings also reveals my own situatedness in the research, even though I am not drawn. As an archivist and historian, decisions made to discard the paper artifact felt like a disruption or erasure of evidence of the negotiation I watched in the design meeting. Reflecting on the initial drawing, this way of analyzing what I saw raised questions for me about what is kept and what is discarded and how everyday practices, legal requirements, and values are implicated in these decisions.

In my pilot study, I focused on individual usage of technologies in the firm. My understanding of the points of collaboration and negotiated process of design developed over time through visiting the firm and analyzing what I found in the pilot study. Figure 7 represents what I saw in practice in 2010 with regard to recordkeeping of both paper and digital artifacts. It identifies that the firm printed documentation, particularly at points of sharing these artifacts with clients and contractors. Digital documentation was maintained, at the time primarily by saving project documentation to CDs or DVDs. Points of frustration are identified as the firm was struggling with investment in appropriate storage for digital data and experiencing the challenges of locating digital project documentation.

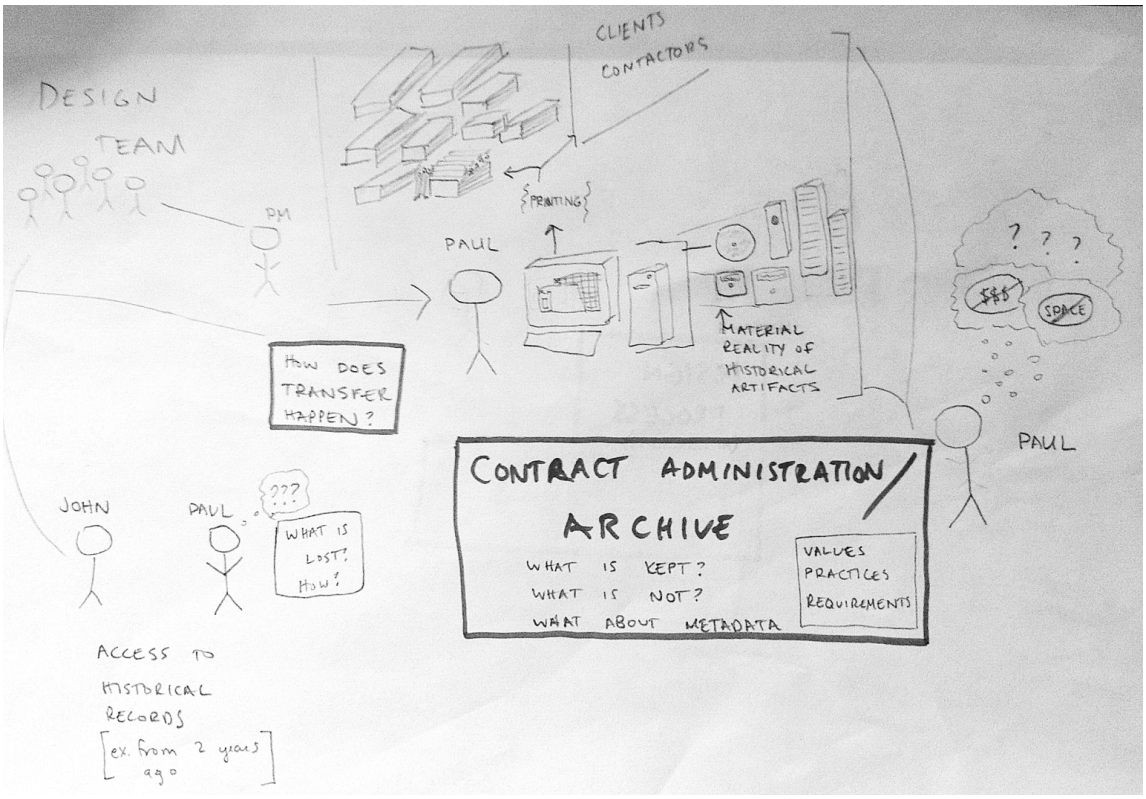

Figure 7. Transfer of files during contract administration

Drawing Figure 7 provided a way for me to capture what I heard about how paper and digital artifacts were maintained and where there were concerns – particularly related to the long-term sustainability of media, space available for storing large volumes of printed records, and the mechanisms in place for locating files.

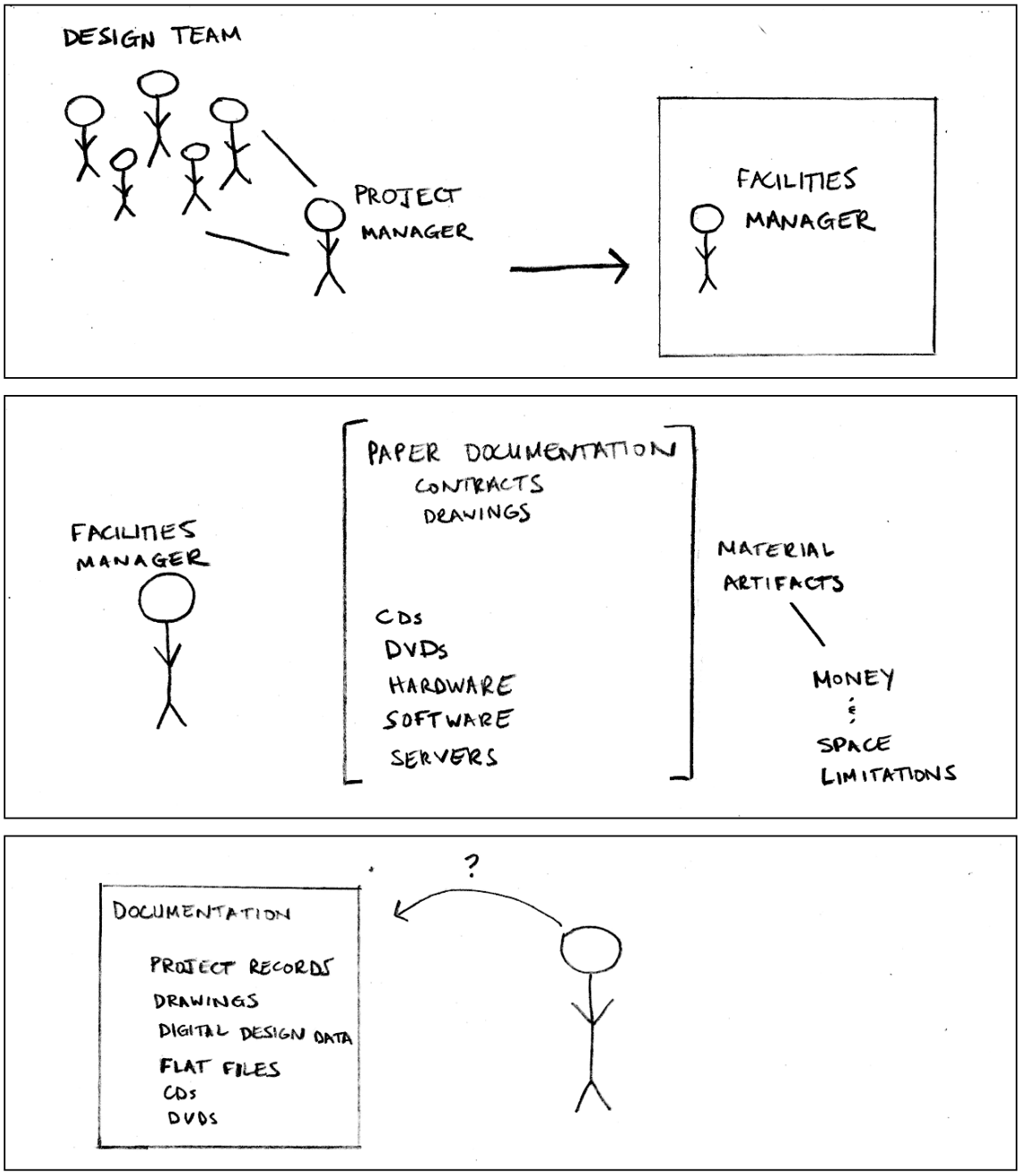

Figure 8. Project documentation management – iteration and reinterpretation

Revisting Figure 7, the value of the original drawing is that it shows several complex interactions I saw or had recalled to me. It represents a portion of a situational map that specifies human and non-human actors responsible for the management of project

records. My process of thinking about the challenges of managing project records benefiitted from documenting the situation by drawing procedures, gaps, actors, concerns, artifacts, and interactions. Once again, I placed the people and artifacts in context, but largely focused on the material reality of transferring, maintaining, storing, and retrieving these files.

Figure 8 is my reinterpretation of the activities made visible in Figure 7. In Figure 8, I drew the activities as a series, which abstracts away some of the rich "in process" messiness, but it clarifies three central concerns:

- how the the transfer of files beyond the design team happens, which I wanted to attend to further,
- the extensive range of storage solutions and descriptive standards over time, and,
- challenges of finding and accessing historical project documentation.

These three contral concerns can be linked to a desire to understand and document workflow and an acknowledgement that data about artifacts are key to preservation and access.

When drawing the initial visualizations (Figure 4 and Figure 7) two years after my initial interviews at the firm, my focus remained on what artifacts were created and how they moved through the firm. Figure 9, below, also drawn two years after my initial engagement in the firm, is an early attempt to get on paper the people, artifacts, and processes that I was seeing. These drawings became "messy maps" through my reading of Clarke. Applying situational analysis strategies to reflect on and revise these early visualizations, as well as create further maps, has built on my inclination to draw out

interactions and document situations. These early visualizations helped guide reflection on and re-interpretation of the pilot study during the lengthy research process by providing me with respresentation of interactions I chose to document as visual reminders of my thinking in process. I drew these interactions by hand at a point of remembering what I saw and choosing to try to represent processes within a single 8-1/2 x 11 sheet of paper.

Figure 9 represents my grappling with the variety of human agents, material artifacts, and processes that related to the interaction between people and artifacts. I had hoped to clearly identify specific, if varied, actors engaged in activities that produced material artifacts, which could be preserved to illuminate practice. Reflecting on the "who" I listed, I see now that I was embedding myself, as archivist, librarian, historian, in a way that also implicates the "how" – by identifying processes that otherwise would not be recognized in architectural work – curation, selection, appraisal. To be fair, I was, by that point, trying to imagine a collaborative strategy for preserving architectural work that acknowledged how these different communities all provide expertise that could be useful for making decisions about what has value. But what initially inspired this early messy mapping was my need to get on paper the range of people and artifacts I had encountered in my studies that seemed relevant for addressing the research problem.

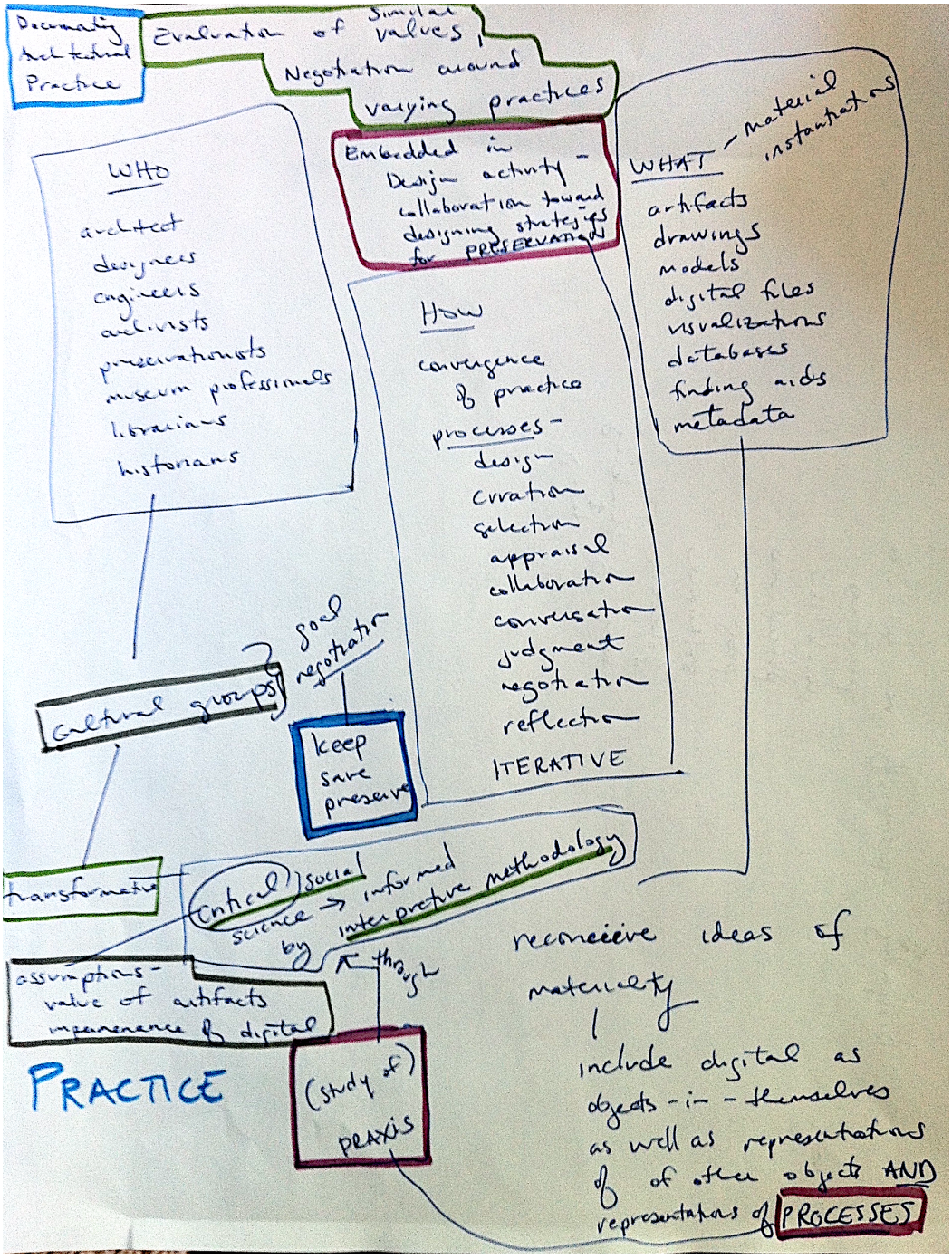

Figure 9. Who, how, and what in architectural practice

This messy map also became a site for exploring my methodology and a place to document my assumptions and developing ideas about what constitutes an artifact of architectural practice. In this way, I am implicated in the messy notes about assumed value and impermanence of digital artifacts as well as my acknowledgement that digital artifacts are objects-in-themsleves, but also representations of other objects, such as buildings, and representations of processes. Figure 10 below provides a clarification, in the form of an ordered social arena map, simplified but expanded to include other human and non-human actors, as well as processes, identified in further engagement in the field.

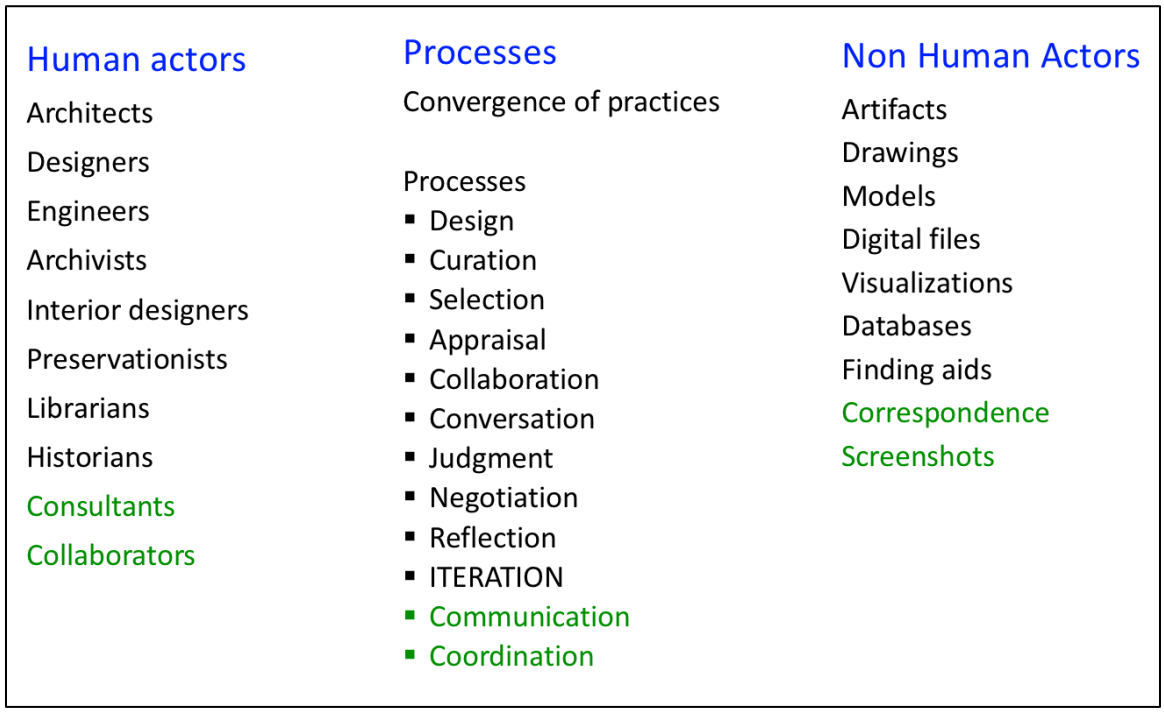

Figure 10. Ordered social arena map, selective

Figure 10 could be expanded to include other human actors, non-human actors, and processes, but also temporal, spatial elements, and related discourses, among others (Clarke et al 2015). For the purposes of this dissertation, Figure 10 points to a way of ordering the messiness as part of the analtyic process and clarification for the purposes of communicating about that process.

The doing of architecture at Jackson in 2010 led me to refine my research based on specific themes: team-based work and the multiplicity of perspectives on technological changes. These themes helped me frame my research in the intervening years.

Team-based coordination and decision-making

The pilot study revealed how much architectural work at the firm was done in a collaborative environment reminiscent of a master-apprentice relationship, with small teams developing an idea over many months or years. Two senior associate architects worked closely with the lead designer to articulate his ideas and develop their own in the process. The relationship, as described by the senior associates and the lead designer, resembled that described by Sherry Turkle (2009, 47-50), where the technologically-savvy apprentice used computer software to draft design documents based on the lead's direction. In the pilot study, the lead architect described how the design began on paper, in rudimentary sketches, but the process of drawing the design took too long for the lead to carry out, so he relied on the senior associates to construct the drawings or models. He viewed the relationship as a typical progression within the profession, stating that "at a certain point in your career you graduate to letting... see, you need more fingers than ten,

so you solicit other people's fingers and then their minds come with them and that is really great." He insisted that it is not just the computer skill of associates that he is relying on, but their design skill as well. According to the lead designer, the senior associates were not good at what they do because of their technical skill, but, due to a number of other qualities, including "creativity, ambition, drive, leadership capabilities, charisma, articulateness, organization." The doing of design at the firm was an iterative process of decision-making and negotiation in which the makings are co-created, with the senior associates responsible for the physical and digital manipulation of artifacts, and all participants contributing their knowledge and expertise.

Changing tools, multiple perspectives

Both senior associates spoke to the need for speed and technical skill in architecture. Learning and knowing technologies were very much based on one's role within a firm and the industry. For the senior associates, working with computer technologies had been a significant part of their design process, whereas the lead designer indicated that it never made sense for him to learn AutoCAD. The lead sketched by hand and verbalized his ideas, and the associates articulated it in AutoCAD, and recently (at the time of my pilot) Revit, AutoDesk's BIM product. In 2010, design meetings took place in the conference rooms, over printed drawings, away from the technology that created the drawings. The architects negotiated changes in design with pencils and pens on the paper drawing. The lead designer still retained control over the ultimate design decisions, but the

associates had control over using digital design technologies to create and modify drawings and models.

In implementing changes in technology, the lead architect described acquisition as both top-down and bottom-up, insisting that some software decisions can be left to individual architects within the firm. The move to Revit, however, is one instance of a top-down decision, in which he has pushed the senior associates to adopt it. His desire to use Revit, and eventually use it instead of AutoCAD, is based on a perceived increase in control over the whole architectural process, with "better coordination between engineering and architecture and the possibly the ability to get data, get feedback data, as you're designing." The associate architects view Revit as a complementary tool, but one that decreased their control over the design, as there was a perception of less distinction among roles of architect, engineer, and builder, when everyone is sharing the model. There was also a perceived loss of control with the shift as one architect reports "I have worked hard to create a lot of control over the design of the projects that I work on, and I'm finding myself in an office where everyone else knows Revit, and I'm immediately giving up control of the production of the building because I don't know Revit." The technologically-savvy apprentice feels like he is "learning to use his thumbs." The loss of control that comes with learning a new technology will surely subside as the architects continue to work with the software, but the sense of having control over a shared artifact remains problematic. The lead perceived an increase in control because one system will contain all the information about a project and there will be less negotiation with contractors and builders. The

architects who use the software, however, were aware of sharing a file in a way that no longer privileged their contribution to the design.

As described previously, in the pilot study I witnessed the complexity of architectural work, in terms of the number of people and technologies that interact in everyday practice. There were also concerns about how adopting new technologies may change individual roles of the architects. As discussed in previous chapters, the architect relies on the use of artifacts to assert authority and communicate expertise, so transitioning to new tools to create artifacts can have implications for how architects perform their role. While I continued to have concerns about the preservation of artifacts, I became aware that finding ways to investigate the way people work and interact with and through various technologies would contribute to determining how artifacts are created, how value determinations are made, and what these artifacts can illuminate about architecture.

RETURNING TO THE FIRM

In 2016, I returned to the Jackson Architects. While my initial contact with the firm was through the faculty member mentioned above, my primary contact for this portion of my research was one of the senior associate architects from the pilot, Aaron, who is now a design principal. There have been a lot of changes at the firm since my pilot study. Aaron described recent organizational change from a limited liability partnership to a corporation as "transformative."

> Aaron: We now have employee stock-ownership options… It's just kind of changed the ethos of the company to a little bit more of, I'd call it more of an employee-centric workplace.

In comparison to the firm context from 2010, he identified the value of the "re-branding" that has come with this organizational change:

> Aaron: Sort of modernized the company, made our goals and visions more transparent not only to our clients, but to everyone here and the work we're trying to do.

These changes involve updating graphics, title blocks, letterhead, logos – visible traces of the change. He also points to increased traffic on the firm's website and an effort to use social media, specifically Facebook, Twitter, and LinkedIn.

Aaron served as a primary contact, and together we identified a suitable project for my research and the associated project team. He described how as design principal, he was still "performing a very similar role" to the one he had in 2010:

> Aaron: Protecting the concepts that Mike [the senior principal and lead designer] will outline, hopefully supplementing those with some ideas along the way, [serving as] decision-maker when he's not present.

He works very closely with the lead designer, but he clearly articulated the importance of putting together a project team that works well together. In contrast to our exchanges in 2010, when Aaron expressed concern about his level of control over a project when using Revit, he has integrated Revit into his work, describing it as "incredibly collaborative," and acknowledges that the collaboration it facilitates "changed us to think about the way we set up our networks, our infrastructure, to provide that capability." He is speaking specifically of collaborating on project teams, not just within one firm office, but working on one project in multiple offices simultaneously. Following our first meeting, Aaron assisted in coordinating interviews with the project team for his recent residential tower

project, Carson Boulevard Tower.[5] He also identified other staff members at Jackson Architects who could contribute firm-wide perspectives on technology implementations and archival decision-making. I conducted six individual interviews and two group interviews. Table 3 outlines the participants and duration of interviews.

Interview	Participants	Duration
1	Aaron	1 hour 45 minutes
2	Mark	1 hour
3	Aaron	1 hour
4	Mark	1 hour 15 minutes
5	Kelly	1 hour 30 minutes
6	John	1 hour
7	Kelly, Lee, Jason, Sarah, Lisa	1 hour 45 minutes
8	Wayne, Mary	1 hour
		10.25 hours

Table 3. Interview participants and duration

From my analysis of the interviews, four themes emerged:

- Collaboration and teamwork
- Coordination and communication
- Artifacts and demonstrable intent
- Decision-making and keeping.

I examine each of these themes in turn.

[5] Carson Boulevard Tower is a pseudonym.

Collaboration and teamwork

Throughout my interviews in the firm, the notion of design as a team activity emerged. As sociologist Judith Blau indicated, maintaining teams of people that work well together is key to architectural work (1984). According to Aaron, the team leadership comprises the project designer, a project architect, and a project manager. The project leadership team, particularly the project designer, will stay on throughout the project to "ensure that design intent is executed properly." Otherwise, the make-up of teams is fluid and dependent on what is needed for a project, as well as which staff members are available. Aaron describes the team, stating, "It's got to have those three major players, let's call it; project designer, project architect, project manager, and then we'll add design staff and architecture support staff as needed in on the project." Mark, a second project designer I interviewed, shared that the role of the staff is to "identify problems with the criteria that's been established by either the client or the project team leadership, and then they all work together to try to address the issues related to those problems." Both project designers described their roles as leader of a project team, and indicated that they are responsible for communicating and protecting the design intent, as well as assembling a team with appropriate and complementary expertise.

Multiple project team members spoke about how particular technologies facilitate collaboration within the project team. Mark acknowledged that the benefit of the office's adoption of Revit, AutoDesk's BIM software, is that "everybody's working with the same model at the same time," at least the architects on the design team. Others on a project, for instance interior designers, do not work within the Revit model. Kelly, a project team

designer and the project's BIM manager noted that Revit makes collaboration with the team easier than AutoCAD because it reduces the risk of overwriting someone else's work:

> Kelly: It's [Revit] set up that you're all working in your local versions of a master model, and every time you do something it's checking to make sure that somebody else hasn't tried to edit the same element. And so for the most part, that's a pretty smooth process as long as there's some coordination amongst the team to make sure that you're not working right in the same area.

Kelly, and the team, rely on the software to manage the master model, but acknowledge that an essential element of effective collaboration is to communicate with other members of the team. Figure 11 identifies informants at the firm, by name, including the project team as a centralizing feature. As a simplified version of the network of their associations, you can see how one project team member, specifically Kelly, is connected to consultants and includes some of the modes of communication through which she coordinates work with consultants. I must admit, however, that she is not the only one communicating to consultants, thus the acknowledgement of simplification. This messy map was a way of visualizing the network of associations between my informants. You can also see Lee, a member of the project team lined up with John, Mary, and Ben – who each contributed to a firm-wide and industry wide perspective. Lee, as project manager, is responsible for managing the final artifacts of the project team and making sure they are archived at the firm. John, in his role as a construction administrator, serves as a liaison to the contractor, working with the contractor to interpret and adjust contract documents – drawings – to make sure the project can be built. Figure 11 is, in some sense, a way for me to draw the responsibility for and movement of artifacts, especially those moving outside the firm to contractors or consultants, but with the focus on the individual people. It is also a way to

capture all of my informants and to begin understanding their relation to each other. Mark, as drawn in the bottom left corner, is on the outside, which simply indicates that he is performing his role as project designer on another project team, that is also made up of a project architect, project manager, BIM manager, and designers.

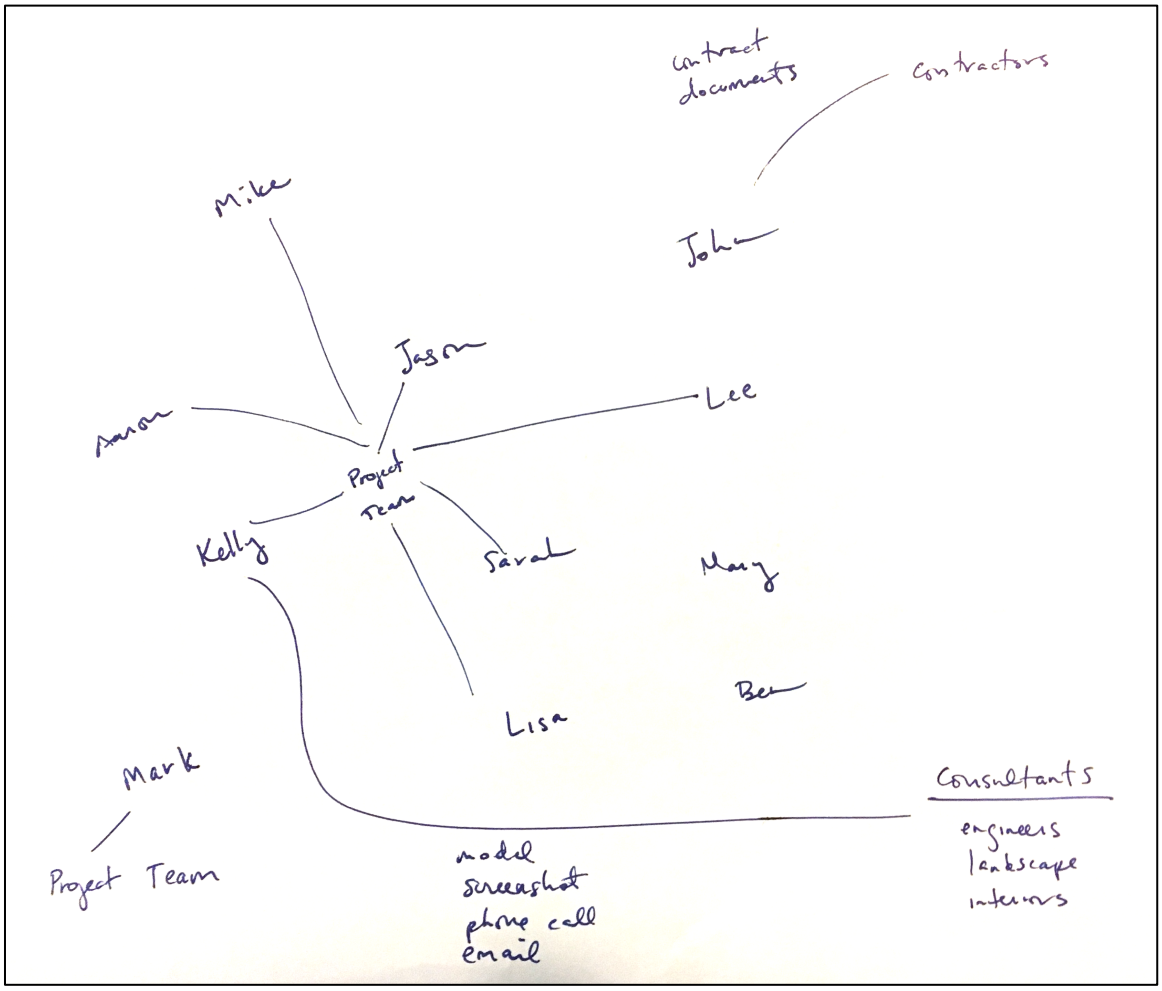

Figure 11. Informants at the firm

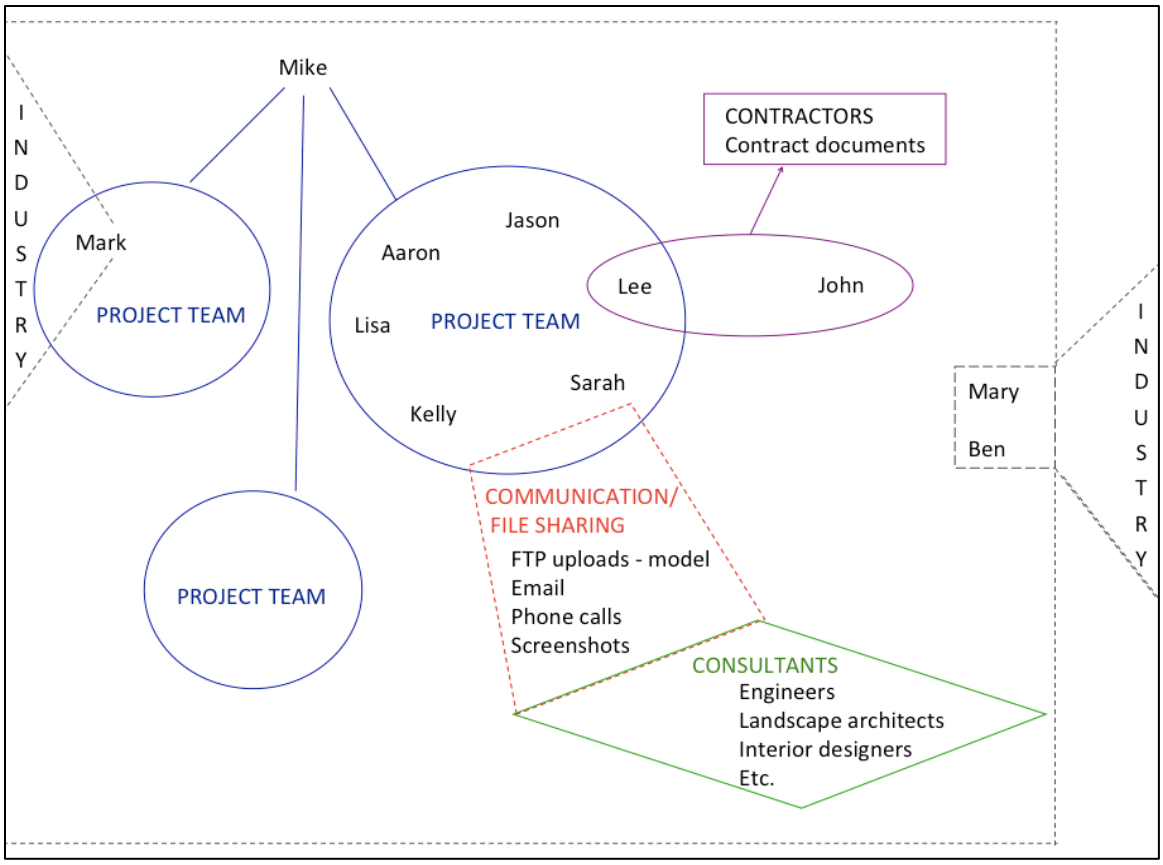

Figure 12. Project social arena map

Figure 12, as a reinterpretation of Figure 11, maps out the network of relations between informants at the firm, specifically as they informed my study. This project social arena map shows my process of understanding the organizational structure of the firm, particularly the responsibilities within and outside the project team. Specifically, in Figure 12, I identified the industry perspectives I gained through speaking with Mary, Ben, and Mark, although they are not the sole participants who informed my thinking about the industry. This is an iteration of the previous map, but it should be noted that Figure 12 is also in relation to Figure 13 and 14, below. Each of the maps was created, revised, and

reinterpreted as part of the analytic process. While none of them can fully explicate the situation, all show my process of thinking, and specifically thinking through drawing the people, the artifacts, and the relations among them that I saw and heard in the firm. As a researcher, I am deeply revealed in these maps, which demonstrate where I focused my attention, on the collaboration in practice.

Collaboration, as described by leaders and members of the team, is the ability to contribute effectively and in a timely manner to the design of an architectural project, and to identify problems as they arise. Within the team, working on the same Revit model requires communication. Both Aaron and Kelly separately recalled stories of what happened when someone notices they cannot sync their local model to the central model:

> Aaron: So, if for instance, we're all working at one o'clock and all of the sudden Sarah notices, "hey, I can't sync anymore or something's not working." We can go back and look at the log and say "well, the last person who synced to the model was at noon. Let's roll it back to that and see if that fixes the problem."

Kelly, in her new role as BIM manager, is actively developing new expertise with the software, learning through these disruptions. She describes her response, as BIM manager, to making determinations about when and why a syncing problem occurs.

> Kelly: A couple of times on this project… either through user error or through strange computer glitches, we've had something go bad enough in the model that we had to roll back to a previous version. That's where the [BIM manager] role is: when something goes wrong then that's who has to fix it. I've tended to err on the side of… actually digging in to do the investigative work to go back through every single previous saved version in the model to find exactly when the problem happened and whose sync it happened on, so that I can find the problem and make sure it doesn't happen again.

The expectation, on Aaron's team, is that it is everyone's responsibility to notice, respond, and help determine what they need to do to recover the model, in order to lose the least

amount of work over a given period. After several years of operating in shared Revit models, staff members at the firm remain calm and know that quick communication is key to resolving model data exchange and coordination issues.

Mark indicated that he feels like they are working toward a more collaborative environment, wherein each individual brings expertise that is respected to the identification of problems. Aaron described recent opportunities to collaborate in real-time over a Revit model, much like what I described previously would take place over a paper drawing. Now, the team could "go into a conference room, pull up Revit, spin the model around on a projector in front of the whole group, then talk about the design of it, and actually add components in real time." He acknowledges that this is the same sort of activity that has taken place over a paper drawing, but before, there would be a necessary translation of the data to Revit, whereas now it all takes place simultaneously. They are investigating ways to add a large monitor that will allow them to be able to take a screenshot and draw on top of it. The desire to create screenshots that they can draw over suggests there is still a desire to work out some changes or options over a static version of the representation (as opposed to making real-time changes to the model). The revised screenshot, if implemented, could become another artifact that demonstrates design negotiation and collaborative decision-making. I will discuss screenshots further below, but it is worth noting that collaboration takes several forms within the design team and that the architects frequently described how a particular tool or artifact functioned or was supplemented to make that collaboration more effective. There is a continual process of evaluating how to use the tools or to combine multiple tools to achieve the goal of collaborative design.

Communication and coordination

The firm recognizes active communication as necessary for collaborating with design team members. It is also essential for coordinating work with other consultants on a project, who are usually outside consultants, such as structural engineers. Lisa, an architect on the project team describes how they use Revit to coordinate work:

> Lisa: The fundamental coordination tool that we're using is the BIM platform which happens to be Revit and having live links to our consultants' models, and then working real time with each other on that digital platform is huge. 95% of our collaboration happens right there, not quite real time. Our Revit model is not hosted on a server in the Cloud that we're working real time with our consultants. But we get daily or weekly uploads. It's almost real time with our consultants. But it is real time with each other.

While the project team collaborates by working within the same Revit model, outside consultants do not have ongoing access to the file, but it is shared on a regular basis. Figure 13, below, illustrates my own visualization of the team in relation to the Revit model. Individual project team members, identified in the figure by their role, all have access to the central Revit model. The notation regarding the software version was to remind myself that knowing which version a project team is using on a given project is crucial, as team members may each have multiple versions of Revit. In the case of the residential tower project, there were weekly sessions to coordinate work with structural engineers on the project.

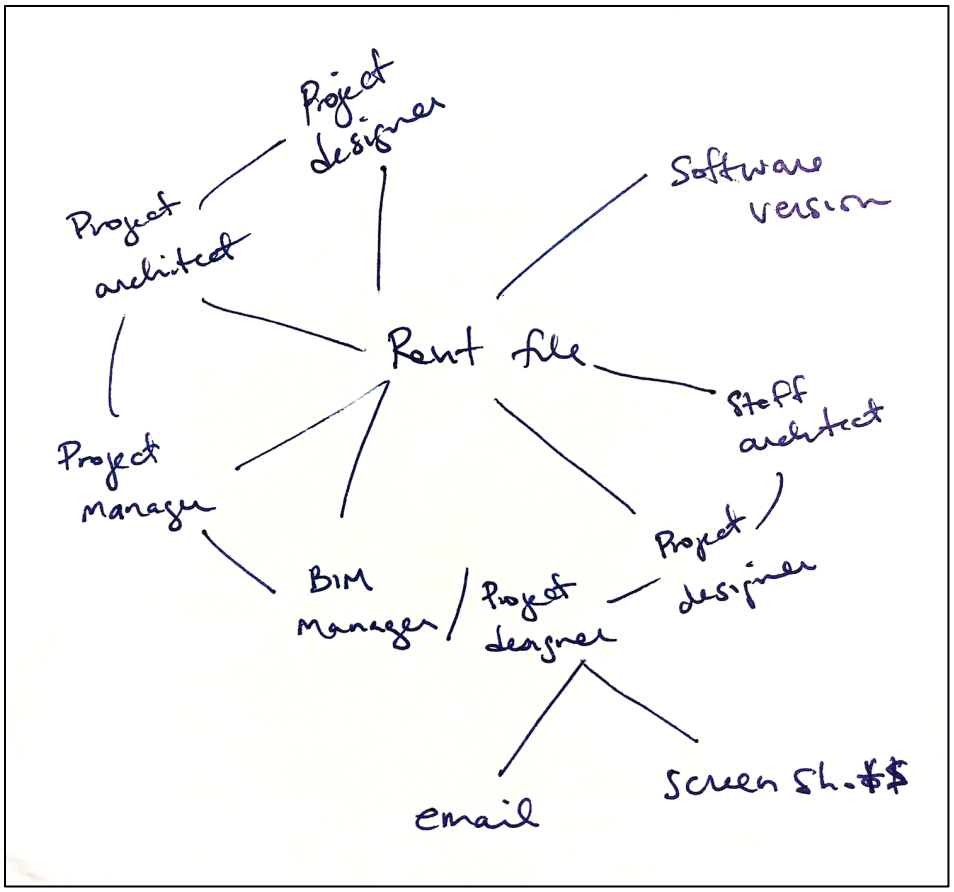

Figure 13. Shared Revit file

Figure 13 is a situational map that served as memory device, a way of documenting the relations between people and artifacts. Clarke et al (2015) describe relational maps as a way of getting these things seen onto paper, to provide a reference for oneself for further exploration, and a way of theoretical sampling through identifying specific relations or aspects of the situation. This version of the map laid out the key relations and captured the note about software versions which I explore later in the text.

Figure 14, below, is an iteration of Figure 13. I was analyzing relations between the non human actor, Revit, and the human actors identified through the project, as well as

relations between human actors and other groups of people outside the project team. The project team is specified as those within the large circle. Each person on the team has direct access to the central Revit file and local versions of the model, whereas the BIM manager coordinates sharing with consultants and the project manager is responsible for transferring files for contract administration. Working to make the initial map clearer helped me to specify relationships and modes of connection. For instance, in the secondary drawing, the green dotted arrows indicate that communication and sharing with consultants is not limited to the BIM manager, but the solid green line indicates that coordination of sharing files on a regular basis is key to her work. This map indicates who and what I identified as important to the the act of sharing Revit files in the situation under study. In this case, the project team, consultants, and contract adminstrators are the relevant participants in relation to their direct or indirect access to the central Revit model.

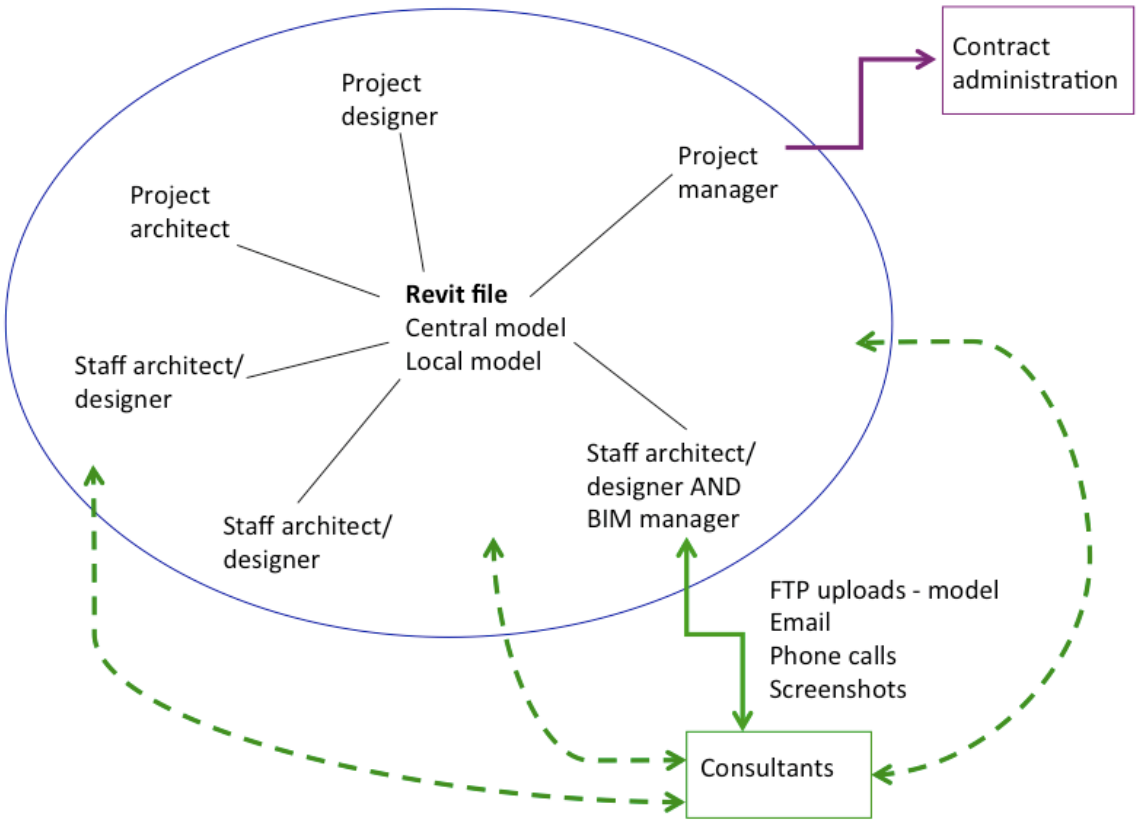

Figure 14. Revit file access and sharing

Kelly, as BIM manager on the project, is responsible for coordinating that work. Aaron describes how the Revit file is shared and Kelly's role in one session we observed:

> Aaron: We have an FTP site where we'll load it. Then work in constant communication with them on a weekly basis. Kelly right now is on a weekly phone call with all the consultants, talking about changes. The model was posted last night. They've all been able - this morning - to get in to the model, look around a little bit. Now, Kelly is verbally describing all the changes that have taken place, or all the potential issues that we need them to work out. So it definitely has to be coupled with proper communication. Old school communication. It's a different method of them being able to understand the building, and its progress.

Figures 13 and 14 also shows the coordinating role Kelly plays, as BIM manager, using other forms of communication to share information about a project with consultants outside the firm. The visualization could be extended to show the FTP site and phone calls, as well.

In communicating changes and controlling the shared model, the architects are exerting authority over the project and sharing architectural expertise, as suggested by Dana Cuff (1992). On this particular project, Kelly serves as significant liaison between the project team and external consultants. She described a recent interaction, which indicates the use of additional artifacts and necessary verbal communication, as well as sharing a Revit model:

> Kelly: We have this storage area we need to fix… so I called the structural engineer to talk through what are the constraints, what I need to know from his end, and while I was on the phone, sent him this screenshot that I'd been sketching on top of our model. So I sent it to him to confirm and talk through it and be able to show him what I was thinking, and then after the phone call sent this out to more people on the team to summarize the conversation he and I had. I think because so much of what we do is visual, it's really hard to have those conversations on the phone without something to look at, and so for a lot of our weekly consultant coordination calls, we have everyone on a GoToMeeting where we can be zooming around in the model live or looking at the sheet that's in question, but there's things like that, where once I'm already on the phone with the structural engineer, and I'm like, "Oh, I wish you could see this. Okay, hold on. I'm sending you a screenshot right now."

Lisa noted, "there's still a lot of interpersonal communication that happens overlaid on top of the digital platform" [Revit]. The project team was quick to add that this communication sometimes takes place in face-to-face meetings, over the phone, via email or instant messaging, and using conferencing tools (such as GoToMeeting). Figure 15 is my visualization of the various communication tools described by the project team. The messy

mapping of these tools, and the difficulty in capturing multiple modes of communication, was a useful way for me to reflect on what I heard in my interviews and to consider how these ways of exchanging information are everyday practice that facilitate the work to be done, but are not necessarily easily preserved. This is a partial listing of communication tools that came up in discussing workflows. I began creating this type of messy map to gather the range of tools used. This messy map captures specific aspects of my research, which Clarke describes as a project map specifically useful in presentation and publication (Clarke, Friese, Washburn 2015). In my choice to both create and share this map, I am demonstrating my continued concern over capturing process.

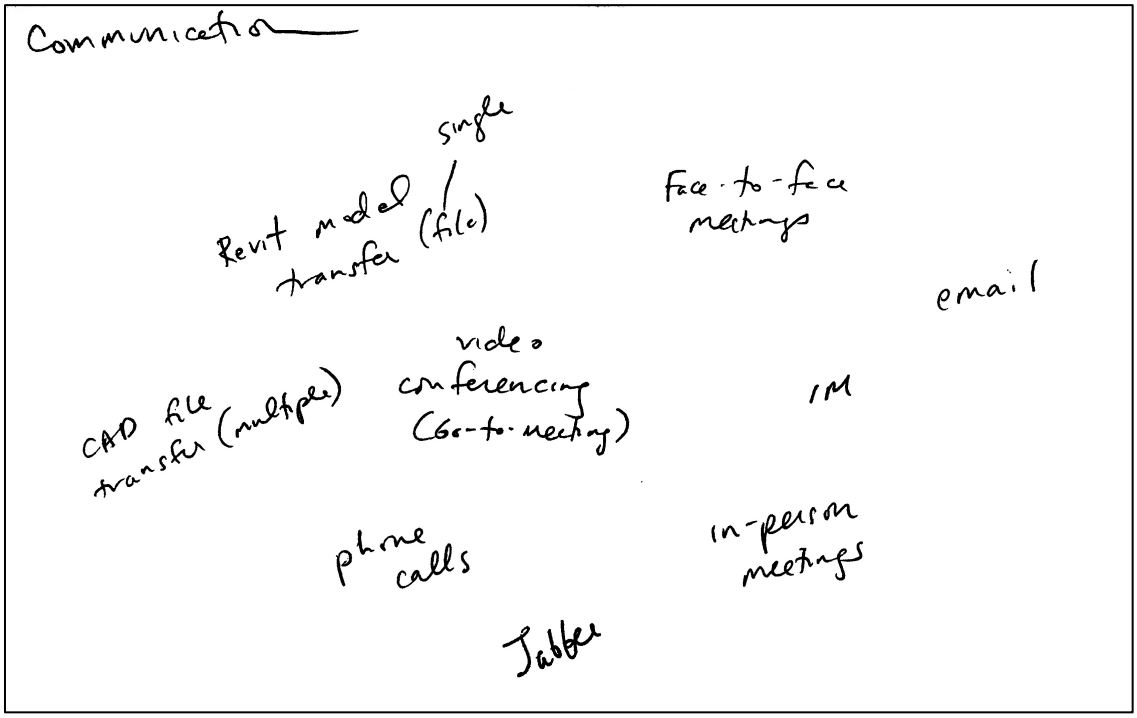

Figure 15. Communication messy map

Donald Schön's "language of designing" is evident in the project team's description of the communication that takes place in coordinating architectural work. Schön states that "drawing and talking are parallel ways of designing" and that "utterances refer to spatial images which they are trying to make congruent with one another" (1983, 80-81). In Schön's narrative, two individuals are engaged in a design review, wherein a student presents her preliminary design drawings and the studio instructor critiques her work. He begins by drawing on trace paper on top of her drawing and talking through his solutions to the problems she identifies. In the work described by the project team, the actors engaged in the conversation are quite different, but the process, and particularly the need for parallel ways of communicating remains. Artifacts, such as the Revit file, the screenshots, or email communications are significant actors in coordinating work with consultants and serve as traces of the doing of architecture in practice.

Given the variety of tools being used and the multiplicity of forms these communications take, it is necessary to consider which of these has enduring value and what decisions are made everyday about the value of the artifacts. It is also necessary to determine which of these *could* be kept and preserved in a meaningful way. Recording and preserving all telephone conversations is perhaps not likely or advised, but it could lend itself to being able to tell stories about how and why a building design changed at various stages of the process, if for instance, modifications are necessary based on requirements communicated by the structural engineer. In the case described above, Kelly communicated the results of her call with the structural engineer to the project team in an email, which will likely be kept in Newforma, but what about the related screenshot?

Artifacts and demonstrable intent

So, how do we make determinations about the value of artifacts in practice? A few key themes emerged from my interactions at the firm. The architects indicated that artifacts demonstrate intent and serve as evidence, which provides the architects with control over the information shared (Cuff 1992). These themes and distinctions made between drawings and models suggest that, for these architects, the value of artifacts is tied to how well they communicate what is needed to the intended audience. Mark identified two audiences and several standard artifacts in the following:

> Mark: We know that as designers, we are going to have to make the traditional conventional drawings: elevations, sections, plans. All of them have to be in addition to describing the quantities and types of things in the project, they must be sufficiently qualitative so that the owners can understand what kind of building they're getting.

…

> Mark: Does the documentation convey the design intent sufficiently that somebody can build from it? We build contract documents, which means that our contract is tied to the clarity of the intent because it's up to the contractor to fill the holes. So for me, what it means is for me to be impactful and to maximize the potential of the project, I've got to make sure that the intent is legible at all the scales from the site plan all the way down to the detail.

In the first, Mark identified that the artifacts must be intelligible to the owners, who likely do not have architectural expertise. Secondly, he expresses the need to demonstrate the design intent, which can ideally be communicated through "very clear qualitative drawings." These drawings serve several purposes, particularly for setting expectations and articulating objectives for the project. The project team can use them to verify and guide further work. The drawings are also a means of communicating to the client and establishing characteristics for the work. Artifacts help to define the design intent and

reduce uncertainty throughout the project, so that project team, client, consultants, and builders can share expectations based on the clear articulation of the design.

Aaron identified how artifacts also function as evidence, particularly in coordinating work with consultants. Multiple project team members discussed the prevalence of PDFs in their work, especially for sharing and documenting activities:

> Aaron: The output of what we do are PDFs more than anything else, so we'll leverage those. We have Bluebeam, we have Adobe Acrobat, and along with that comes a digital record of everything we've communicated or asked our consultants to do. So two months from now when we're at our final drawings and we're like, "Hey, we asked you guys to move this or to look at this around," there's not a whole lot of guesswork in terms of when did we ask you and did we in fact ask you. Yeah, there it is. That PDF goes as part of the project archive. The marked-up PDF.

His response indicates specific digital tools that facilitate this work, but also evident in his description is the value he ascribes to the artifact – he can point to it as evidence of what and when something was communicated to consultants. Artifacts, such as the PDF described above, are evidence of decisions made and communicated in the continual negotiation process, and as such they also help an architect maintain authority, as suggested by Dana Cuff (1992).

It is clear that both a range of artifacts that serve different purposes within practice and multiple types of documentation will be necessary to document practice. Individuals within the firm make decisions every day and set long-term policies that will have implications for what documentation is kept. In the next section, I examine what I learned about how these decisions are made.

Decision-making and keeping

Deciding what to create, share, and keep is part of the everyday work of architectural practice. In my interactions in the firm, several people indicated major shifts in keeping practices based on the transition to digital documentation. The increased ability to retain "everything" was identified by multiple staff members, as was the need for ways to organize project documentation to facilitate access to files.

In terms of making decisions about what has value, two project team members identified project phases as one means for determining value:

> Lee: In the 60s or the 70s, 80s, the 90s even, I think there was - I haven't really thought about this completely - but I think that there was a more deliberate, apparent understanding of what could be archived or should be archived, because you had a stack of drawings, like Sarah talked about, that you knew, "God, these are the originals and we need to save this because it's a deliverable, a schematic design submittal, or a design, an open submittal." Now, you've got all these interim versions of things. Sometimes there's just so much information, it's hard to sift, because you may get down to four files and you're not real sure which one. But back in the 60s to the 80s or 90s, I think it was more clear about what ought to be archived, more clear about information.

Lisa followed up on that by describing architectural work in terms of phases, which she indicates can provide clarity about what to keep through identifying milestones and the associated artifacts:

> Lisa: If there's a schematic design presentation, that presentation is probably worth saving, because there are a lot of big ideas being sifted through for sure, and that's usually-- then the project changes from that point. And then the design and development presentation is probably worth saving because there are probably big technical ideas and big technical things being discussed, and new MEP systems or new energy-- so there are those big decision-making moments where usually some big steps is being presented. And they're milestones. This particular project, those milestones aren't so clear, but I think you would find other projects probably in this office as well as other firms have big milestone presentations that are worthwhile.

Milestone moments in a project, when decisions are made and communicated, certainly seems to be a means for determining what to keep, particularly for the purposes of serving as evidence, as described by Aaron.

Members of the project team make decisions about organizing information and documentation for a project. Creating meaningful structure for keeping artifacts of practice requires not only setting up the system to do so, but effectively communicating with and setting expectations about file management behavior for all staff members:

> Kelly: We have a consistent file structure that every project uses, but we don't have a consistent way of using that file structure. So different people within the office are just putting things where they think makes sense within that file structure, but we've never had any conformed training about what each folder is really meant for.

A follow-up meeting with the project team as a group resulted in an acknowledgement of how recordkeeping practices are context-specific, at a firm level and even at an individual project level. Lisa described working in a different firm and her perceived benefit of enforced structure.

> Lisa: I've come from a firm that had a very clear file structure. It was enforced. So if you didn't use it you got yelled at. When I first came to that file structure it really troubled me I think because it feels very corporate and rigid. However, you don't have to use it very long to really appreciate it because you can find stuff. And you know where to put stuff, and you don't spend hours looking for stuff.

Concerns over being able to find information, particularly project documents, came up frequently in the interviews. One of the challenges the firm is actively trying to address is file naming standards. John mentioned a subcommittee for the office that, among other things, is talking about file naming and project folder structure.

Figure 16 is a messy map of specific software and tools used by the project team, with indications about which are industry specific. The circles indicate my attempt to group these into (1) drawing and modeling, (2) document exchange, and (3) project management/general communication. These grouping attempts were useful in my own sense-making, but they should benefit from further revision, particularly with regard to project management and communication. They still feel limited and incomplete, but reflecting on this visualization now, circle (1) focuses on tools for doing specific architectural work, drawing and modeling, (2) focuses on concrete tools used to share the artifacts created through doing that work (the makings) – specifically how static images are used to transfer information about dynamic design, and (3) focuses on means of communicating and coordinating complex project work. In each of these groupings there are technologies that have been specifically designed for the architecture, engineering, and construction industry, as well as tools with wider application. Revit, AutoCAD, Bluebeam, Navisworks, and NewForma are all primarily used in architecture, design, engineering and construction.

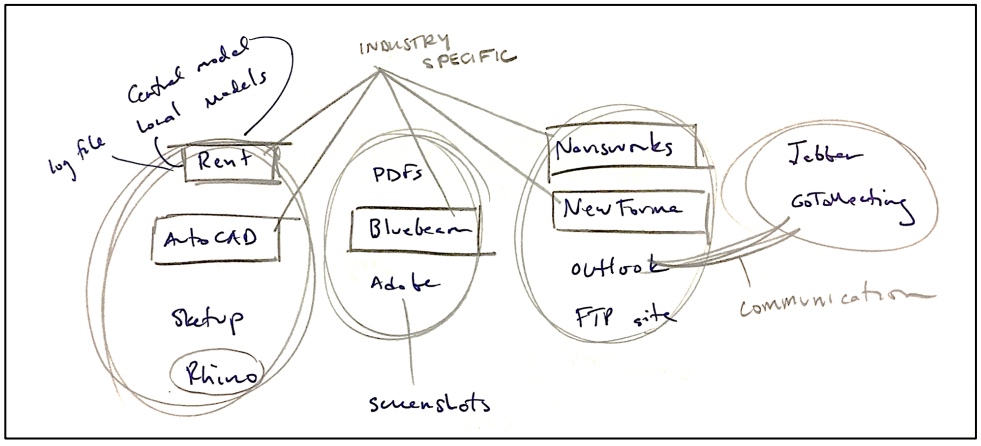

Figure 16. Artifacts, including industry-specific software

Drawing Figure 16 initially was a way to use the data I gathered in my notes and messy maps, then organize it – first by considering these groupings by function or type of work and then by seeing relationships between these tools through making these connections visible through drawing. This visualization is an intermediary drawing that helped me to see that the design team was using industry-specific tools but also used other tools, some of which are widely used outside the industry. Several of the non-industry-specific tools are particularly used to communicate with collaborators and clients. Each of these tools both is an artifact of practice and generates artifacts, such as screenshots, iterations of drawings, and email. Figure 16 also became a tool I used to note things to return to, in both further interviews or my analysis, such as screenshots.

In addition to the Revit model and associated drawings or PDFs shared, as I have shown, there is a large amount of communication that takes place. Kelly describes one specific way of organizing communication about a project:

> Kelly: We're all emailing in Outlook but then any email that we feel is significant to the project we're filing into Newforma and ideally associate it with an action item, if there's one that's really-- we have action items set up for a lot tasks. Right now our project has 23,000 emails in here, but the nice thing is it's everyone's emails that have been filed, all collected in one place, and they're searchable by subject, or by sender, or by a number of other things.

One key thing to note in Kelly's comment is "any email we feel is significant," which points to the active decision-making and value construction taking place in everyday practice. Keeping an email involves transferring it to Newforma, which requires active decision-making. When I noted that Kelly's interaction with the structural engineer was likely documented, I was referring to this active decision-making and my presumption that following up with the team members indicated she felt it was significant. There is also the

possibility that more than one project team member filed the email in Newforma, which means not only would it kept, but duplicated, with the screenshot as an attachment.

John is the “liaison between the design team and the contractor,” who makes sure the contractor understands the drawings, communicates changes that need to be made, and saves project documents, such as change orders, in Newforma. He spoke to what he sees as a determining factor for whether iterations of a drawing are saved:

> John: If something exists and is done in the digital world, it's saved. There's no reason not to. If it was done in a paper world, it's probably not going to be saved. I'm marking up a set of drawing right now by hand, and I'm going to hand them to someone. And they're going to go through, and they're going to make that change, and they'll highlight that they did it, and go to the next sheet and highlight it. And when they're done, they're going to throw it away. You know, if I was marking it all up digitally, they'd never throw that away. At the end of the day, you're going to do whatever is easier. And it's easier to save something that's digital because it takes an active action to delete it. Whereas it's easier to throw away something that's physical. So just going to default to what's easy.

According to John, while there is still a lot of work done on paper, the artifacts that get saved currently are digital, and often digital surrogates of paper documents. Several members of staff, including John, indicated that the office was about to be remodeled and that everyone is evaluating what they keep in their workspaces, with an emphasis on reducing paper and physical samples. This effort includes removing flat files that hold drawing sets, although the final destination of those sets was not known. One person suggested that there is the attitude that, "Well, we have a PDF of it, so why do I need to keep the paper?" Jackson Architects, like many organizations, including libraries and archives, is trying to manage their limited space and is prioritizing keeping artifacts in digital form, when possible.

So many of the artifacts are created using complex digital technologies, which raises questions about how software decisions are made. The transition to fully integrate BIM into their work practices by using Revit has significant ramifications for the office, both in managing software licenses and preserving the artifacts created. Ben, the IT software director, spoke to managing Revit specifically:

> Ben: We typically haven't run into an issue where we couldn't migrate something forward if we needed to look at it. But if we're using Revit specifically, it's not backwards compatible. Once you transition a model to a newer release, you can't go backwards with it. We've run into problems with jumping those things to a next version. We really hate to do that during the course of a project, if we can help it, because we've seen things disappear from the model or change in the model unexpectedly. And when you're producing construction documents that you have to put a seal on, those are changes that really should be flagged to the contractor when you issue them. Our stance is once we establish a version for a project, models in the project, we normally try to stay with that. But we wind up having to manage multiple versions. We have three or four yearly release cycles right now running concurrently with our teams.

In one of my individual interviews with Mark, he indicated that he was maintaining Revit 2013, 2014, 2015, and 2016. While it is possible to transition a model to a new release, it can cause problems. Additionally, knowing which version was used to create a model is important to make sure to open files with the correct version:

> Mary: We've discovered in recent years with the versions of Revit, we used to not name our models with the version in it but now it's important for us to put what version year that we are archiving.

The Revit model is described by multiple people as a tool that helps to generate drawings, which are the standard artifacts of practice and serve as contract and construction documentation. But as the firm, and the industry, increasingly uses BIM technology, there are reasons to ensure access to these complex digital artifacts. Aaron identified one reason, based on his own recent experience:

> Aaron: Once it gets past a certain point, the thing that I could see that could trigger would be any kind of presentation drawings that-- like for the Smith Concert Hall[6] that finished construction last year. It's got published in *Regional Architecture Magazine*,[7] so actually I had to go back into the Revit model, open it up, prep the floor plans for presentation. Quite frankly, you can't pull that from a construction document. You're going to have to go in and actually open that model. So I bet actually, just saying that now and thinking of it now, I bet our IT and folks like John and Mary are not thinking like that. They only think about in terms of the legal construction standpoint. I'm almost certain no one's actually brought that up yet, about the fact that we could actually easily have the need to recreate presentation drawings for these years after the fact, and what are we doing to protect that?

Fortunately, he was able to access the model needed, but what if a similar request comes in 5 years, when he is no longer maintaining the correct version of Revit?

AGENCY/INTENTIONALITY AT THE FIRM

Artifacts actively participate in everyday practice at the firm and continue to function as agents that communicate, telling stories about how buildings are designed, illuminating how decisions are made in negotiations with consultants, and documenting how many people collaborate in the development of a single project. What I have gathered is that the firm is heavily invested in protecting project documentation and they are actively discussing about how to manage documents within the office in ways that make sense given their current everyday practices as well as their previous workflows. They use Newforma to organize project documentation, move content to an archives server, and make files read-only. But they also acknowledge that discovering and accessing files depends on having the appropriate software, associated files, and metadata that may or may not be adequately

[6] Smith Concert Hall is a pseudonym.
[7] *Regional Architecture Magazine* is a pseudonym.

preserved as files are moved. Human actors make intentional decisions that have implications for which artifacts will tell stories and how the stories are told.

The project team is very aware of how their work is promoted to the architecture community and the public and the implications of coverage in the press and through social media. Lisa points to how documentation of architectural projects serves as sources – for research, to determine precedents, for inspiring future work. She describes conducting research on a building and architectural journals as the "public archive." Many of these serial publications document a building, provide information on the architect and collaborators, and include photographs and drawings. The publication of a building told the industry about current projects and allowed future researchers to study what was built:

> Lisa: Well, I think there's an interesting aspect of this to-- it wasn't that long ago - less than ten years ago probably - that especially if you're an architecture student you're looking for significant projects to do some research or precedent, you'd go to specific magazines who have really good-- that's our public archive, is like a 30-year-old *Architectural Record* or something. There are journals who published significant projects or technical development. And there were these really good resources in hard copy. And these are now available in electronic. But that's the old days because now there are blogs and even ArchDaily-- there is so many projects out there - most of which aren't significant - that are getting published. Some of them are significant that are getting published. It's like sorting through the media archives seems like a whole other aspect because that's part of the public archive process.

But the quality of the content depends on who controls the content, and some sources are not necessarily accurate:

> Lisa: That's what was different about those articles and those publications of *Progressive Architecture*, because usually it's vetted. The architecture firm has looked at it, controlled that content, the other consultancies, the owner. It's fully vetted and it's probably pretty close to accurate, maybe not completely accurate, but pretty close.

Other sources that cover building development are not vetted by the architecture firm, and, depending on the publication, the intended audience, and the motivation to publish information on a building, the information published varies. Kelly provides a specific example that illustrates how intentional decisions, often made by people other than the architects, may determine which artifacts document a building:

> Kelly: The project we're on right now, doing residential development, has had limited information released to the public at any given point in the project, and it's important to the developer to control the marketing and everything of that to some degree. But what's happening because of that is-- we started ground breaking this week. We've had several articles go online about the building, and this was one that Lee had emailed it out to us yesterday that's got a rendering that's a year and a half old, a new photo from the ground breaking, a rendering that's about a year old, an old version back when we had a circular core in the building, which has been gone for about a year, and a brand new rendering that just was released this past week to the public. And then another one where-- this one is much better and has all new renderings. I don't think they're showing anything old in here. But it's this funny thing of this is an article that just came out this week, and is part of the public record. And if anything's going to get archived on this project, presumably anything that's in public media about the project is part of that. Most people reading this article don't know how out-of-date this is. It's glaringly obvious to us.

In the absence of maintaining artifacts of the project team's everyday practice, researchers may be limited to what is published on the building, which may or may not be accurate or complete. Artifacts, such as the renderings and photographs in Kelly's example, are agents that continue to communicate about the design and construction of the building. As published they serve as documentation of these processes that will likely be available to future scholars looking to study the residential tower project. But how can we preserve multiple, potentially conflicting, artifacts for this project that reveal the negotiations in design and construction, as well as in the narratives constructed around built work? What

can, and should, become publicly accessible in an archives? These decisions will require a network of people actively making decisions that are context specific, project and firm specific, and require archivists to actively make recommendations about how to manage artifacts. Ultimately, the artifacts that are kept will be based on decisions made in everyday practice – both architectural and archival, and best decisions will be made at the intersection of architectural and archival practices – in deliberate, thoughtful conversation about what has value.

Understanding the specific context and recordkeeping structure will be necessary for being able to describe and provide access to related artifacts in a meaningful way. The variations in recordkeeping structures across firms and enforcement of standards is telling as well, and worth further exploration. These activities suggest something about the perceived value of artifacts of practice, or could be a long-term result of adopting computer technologies for practice, or could be driven by changes in personnel and firm resources. As I write this, I realize I am positing social and technical reasons for these variations, while it is likely a combination of these and other factors not suggested above that has resulted in variations in practice as firms have each grappled with managing large quantities of digital design data in different ways. Archivists will similarly grapple with variations in what has been kept, at multiple levels - a firm, a project, an individual architect. That is the challenge. My suggestion is that we should continue to ask and document how firms addressed these challenges because actions taken (or not taken) to manage digital design artifacts tells us something about what is done in architectural

practice as well as contributing to what we know about the history of computer use in the industry.

CONCLUSION

In Chapter 5, I engaged architects in conversations about their work, technologies used in collaborations, and the resulting artifacts of their practice. I revisited my findings from the pilot study, which helped reframe my research. Particularly, the pilot provided a lens through which to understand the doing of architecture as a negotiated process in which multiple people and technologies interact in the design of a building. Artifacts not only function as agents in these negotiations, but can serve as traces of the interactions and things that help document the collaborative activity. When I returned to the firm, I brought a different perspective that focused specifically on the people and artifacts in performative relation and a concern for how value judgments made by humans have implications for non-human artifacts.

Re-entering the firm allowed me to address the following specific research questions in one situated context:

- What is the role of artifacts in architectural practice?
- What are the processes that lead to artifact creation, destruction, and preservation?
- Who makes judgments about which artifacts to keep in everyday practice?
- How do artifacts figure into decision-making processes?

This chapter presented architects in conversations with me and with each other about the decisions made in practice, the value of particular kinds of artifacts, and the everyday

working practices that have implications for which artifacts will remain accessible and meaningful for future storytelling.

So what do we know now? What does this description of architectural practice tell us about what architects do and what they make? How can this story about architecture help address the archival challenges set forth in the introduction: the volume, duplication, dispersion, impermanence, and technology-dependence of artifacts? And how can we address such questions in ways that will allow architectural historians, cultural historians, architects, archivists, and others to understand what the contemporary doing of architecture is like? What elements of architectural doing of the moment must we engage and consider to allow them to do their work in a fruitful way that reflects what architects do? In the next chapter, I will discuss what I learned about the doing of architecture, identify themes for framing activities in architectural work, and present key findings related to preserving architectural artifacts.

Chapter 6: Discussion

Architectural practice is a dynamic collaborative activity, involving networks of actors in the creation, distribution, use, preservation, and interpretation of architectural artifacts. The traditional mode of attributing architecture – buildings or paper and digital representations – to single creators might have always been an incomplete telling of the story, and it is most certainly not an accurate portrayal of contemporary practice. Rethinking how archivists can address challenges of collecting contemporary architectural artifacts begins with an acknowledgement that "buildings are produced through shared processes held together by shared knowledge… rather than through acts of individual creation" (Davis 1999, 5). In the study reported here, I sought to understand the changing artifacts of architectural practice not merely as the result of technological changes, but as traces of the social context in which they are created.

Studying architectural practice and the artifacts of practice is challenging – the number of individuals engaged in building culture and the variety of things made through architectural work complicate the documentation of the field. Archival scholars have addressed ways to acknowledge the volume of artifacts and complexity of practice by positing broad approaches to addressing the vast quantities of artifacts created. Terry Cook (1996) advocated a top-down and functional approach in “macro-appraisal” that provides a strategy for archivists to take on an active role in research and decision-making, as opposed to seeking to determine “value” in records. Richard Cox (1996) similarly encourages a broad perspective on documenting architecture using archival documentation

strategy, but he also suggests collaborating with creators, users, and record keepers to inform appraisal and preservation efforts. From both of these approaches, I benefit from an insistence on archivists being actively engaged in decision-making about the value preservation of artifacts and not passive receivers of records. So instead of maintaining a focus on broadly documenting architecture, I flipped the model to focus specifically on deepening my understanding of architectural work and providing a historical narrative as a context for my case study. I gained embodied knowledge through learning architectural technologies and took that knowledge back into engagement with one firm, one project team, one project – to investigate what has value in their work based on what they do, what they use, and how they value the material artifacts of their practice. Beyond this intimate engagement with one project team, what can we know about architecture – about the building culture in which these individuals operate?

Seven descriptors of architectural practice emerged from my qualifying paper and subsequent discussions with my dissertation committee. The matrix below was constructed at a point in my research when I needed to focus on what each of my three methods contributed to my thinking about architectural practice. It identifies each research method used in my dissertation study and what each can tell me about the descriptors I have used for architectural practice.

	Cooperative	Relational	Iterative	IT Mediated	Value-laden	Material	Performative
History	Architects involved in technology development	Theorists, architects, etc. in conversation about roles	Incremental changes to technology	Points of intervention, innovation	Multiple perspectives on role of architect, computers	Assumptions built in	Identities within practice re: technology
Reflect	Master/ apprentice relation	Educational environment around technologies	Repeating, Learning	Knowledge transfer	Assessing/ challenging own values	Allowances, constraints – as felt in learning	Becoming a maker – identity adaptation
Engage	Design team, collaborators relationships	Network of people and artifacts	Negotiated decision-making	Information transfer – within, outside firm	Decisions about artifacts, work	Affordances and limitations, reliance	Identities within practice re: technology

Table 4. Methods and architectural practice descriptors

In the next section, I will address how we might think about what architects do and what they make, before addressing the archival challenges of preserving artifacts.

FRAMING THEMES FOR DOCUMENTING ARCHITECTURAL PRACTICE

Four themes emerge from my research that are useful for moving beyond a description of architectural practice to considering how studying individual and collective activities can provide a lens into the situated meaning of artifacts and how humans and artifacts interact in everyday architectural practice. These themes are: uncertainty, iteration, future-orientation, and agency/intentionality.

Uncertainty

As described throughout this dissertation, architects face a great deal of uncertainty in their everyday work. Nicholas Negroponte (1970) argued that key role of an architect or designer is to deal with missing information and to face uncertainty and that machines for architecture should be designed to handle these same conditions. As we saw in practice, architects have incorporated computer technology into their everyday work practices, using many technologies that are specifically designed to manage the complexity of architectural work. Artifacts can tell particularly stories about facing uncertainty in practice. The artifacts we choose to preserve can obscure or embrace uncertain, everyday negotiations in architectural work or over-simplify the messiness of practice.

One role of artifacts, as described by the architects I interviewed, is to reduce uncertainty, to serve as evidence of decisions made and clear articulation of their intent. Specifically, Aaron identified artifacts as serving as evidence to document when and how specific information was communicated to consultants, for example in a marked up PDF of a drawing. Kelly created specific artifacts (screenshots) to illustrate what she was describing over the phone to consultants, as a means of clarification, thus reducing uncertainty about what she was trying to communicate. In Aaron's example, an artifact documents a specific decision made and communicated. In Kelly's, the artifact demonstrates decisions-in-the-making, as a thing that facilitates the negotiated process of designing a building in coordination with a team of people within and outside the firm. These artifacts can also embrace and document the uncertainty of practice. The marked up PDF, for example, if preserved in relation to other iterations, could not only serve to

document the articulation of intent and a decision made and communicated, but the negotiated process between project team and contractor and the kinds of conflicts that arise during construction. The screenshots demonstrate the need to provide visual representation of the shared project as well as, in this instance, a need to create a secondary visual because access to the Revit model is limited. Both examples illustrate things architects do – they coordinate work, they communicate expertise, they negotiate changes, they exercise control over the design of a building, they operate within an architectural information system. Artifacts are active participants in the everyday doing of architectural work as well as evidence of what was done, what was decided, and who was involved.

Managing the complexity of information in architectural artifacts, including making determinations about what to share and when, is one way architects demonstrate expertise. Much of the technology developed since the 1960s was designed to help manage and communicate information about architectural projects more effectively, particularly to others within the architectural information system. Nicholas Negroponte called for architects to partner with researchers in engineering and computing to design machines that could confront uncertainty. I extend that call to other researchers who can help address the challenges of now managing digital design data in ways that make the uncertainty visible – as a way of more clearly articulating what architects do and making the things made meaningful.

Iterations

Iteration, the second theme, describes both the activity of responding to changes and the

physical manifestation of these actions. Donald Schön (1983) describes architectural work:

> [A designer] works in particular situations, uses particular materials, and employs a distinctive medium and language… The designer's moves tend, happily or unhappily, to produce consequences other than those intended. When this happens, the designer may take account of the unintended change he has made in the situation by forming new appreciations and understandings and making new moves (79).

Schön's (1983) "designer's moves" and Pickering's (1995) "dance of agency" both can be seen in the interactions of people and artifacts in architectural work, wherein humans act and re-act based on temporally emergent circumstances. Iteration is one way to think of this continual becoming or incremental change, whether it is in the design of a single building or in the shifting technologies used in everyday architectural practice. Iteration identifies an altered or amended course of action, a performative response, over a period of time, in response to other actors, human or non-human. Artifacts created through these moves produce new iterations (of a project design, for instance). Iterations demonstrate changes made for many different reasons – design choices, conflicts, decisions, code constraints, client demands, detected clashes, to name a few. Artifacts that document various iterations allow for understanding how these changes happen over time.

What is made in architectural work? I argue that many things are made and that some of these makings can be preserved in ways which illuminate the work itself. Design involves incremental changes, and much architectural work is marked by phases that result in specific artifacts. For example, during Schematic Design, Design Development,

Construction Documentation, Bidding and Negotiation, and Contract Administration,[8] architects generate specific artifacts. Architects at Jackson indicated that these are the likely to be preserved, since they relate to the contract with a client. But they also acknowledge that these phases are less clearly differentiated and less defined in their current working environment. Other iterations of a design – the initial creative development drawings and the various iterations leading to a final version shared with a client or contractor – have value for documenting process, but lack the business and legal imperative for preservation. Since the 1960s, the design of software for architecture has produced numerous programs, which each may have several versions (or iterations). Recalling Pickering, I have shown how in architectural practice humans and non-humans agents are engaged in performative activities, wherein agents act and re-act to temporally emergent circumstances. Pickering's concept of material agency and a performative understanding of work activities is useful for framing the iterative processes described in collaborative practice. The material artifacts of practice, and particularly several iterations, can illuminate this performative quality of architectural work. But decisions still must be made about *which* iterations, or, if decisions are made to keep all iterations, we must do the work to preserve them in ways that allow for meaningful storytelling. What will make these iterations intelligible without overly prescribing narratives about their creation and use?

[8] Phases as identified as "basic services" in the *The Architect's Handbook of Professional Practice* by the American Institute of Architects, 2014.

Future-orientation

Architecture is future-oriented in at least two ways. First, as described above, the work is fundamentally about designing and constructing structures, creating and refining a design over time, which implies an orientation toward a future state of built structures and a future way of life for those who will inhabit the structure. Computer-Supported Cooperative Work scholars Kjeld Schmidt and Ina Wagner describe how architectural activity differs from other types of work in that the field of work – in the form of representational artifacts and final built works – does not exist prior to their work processes, but is created through "successive objectifications" of the project (Schmidt and Wagner 2004, 363). Suggesting Heidegger, although not explicitly, Schmidt and Wagner state that architects construct artifacts as a way to make "the not-yet-visible and in-the-process-of-becoming field of work immediately visible, at-hand, tangible" (Schmidt and Wagner 2004, 363). This in-the-process-of-becoming is characteristic of the future-orientation of architectural work. Artifacts can make this orientation intelligible, as well as clarifying the complex social activities that determine whether a building is built.

Second, as a business enterprise, architecture is driven by the need to continually seek new projects. As Aaron recalled, he has received requests that require him to recreate presentation drawings for publication. His concern about being able to access and recreate presentation drawings is tied to promoting the work of the firm, which is at least partially motivated by seeking future business. It is difficult to predict all potential uses for artifacts of practice, but Aaron's publication request serves as one example of a foreseeable challenge in the near future. Artifacts of practice can represent multiple things, and their

meaning can change over time and for different groups of actors. The key is acknowledging that documenting architectural practice is a moving target in many ways. Buildings and the artifacts described in this study are always in the process of becoming. The records continuum model acknowledges how records are always in the process of becoming and are not time-bound (Pearce-Moses 2005) or limited to simply being products of activities (McKemmish, Upward, and Reed 2010, 4447).

Agency/Intentionality

Throughout this dissertation, I have presented many ways artifacts act in everyday practice. Accepting Lucy Suchman's (2007) definition of agency as the "capacity for action" (2), I assert that artifacts of architectural practice not only participate in everyday architectural work, they continue to act in their capacity to perform roles beyond their original intent, taking on different meaning at different times. Take for instance the residential tower drawings that were published online. Initially, these drawings may have been active participants in communicating a design scheme to the client. In their published form, the drawings act as agents to gain public interest in the project and potentially to help sell units within the structure. The artifacts are not intentional in these activities, but human actors make intentional decisions about the value and use of these artifacts.

These artifacts can illuminate characteristics of architectural work, if we actively choose to keep those that document these everyday, uncertain, complex, collective practices as well as the buildings. I also embrace Albena Yaneva's approach to studying what design does through mapping uncertain situations, multiple perspectives, and

changing actors. We must seek multiple expressions of agency in the artifacts we select and acknowledge our own agency in the selection and description of artifacts.

PRESERVING ARCHITECTURAL ARTIFACTS

I am using my research as an opportunity to examine architectural practice and to use what I have learned about practice, both from the history of technology development and my own embodied engagement, to rethink what we keep. The goal is not to provide a guidebook for what to collect but to provide a lens trough which we can approach archival appraisal for architecture. My recommendations for thinking about what architects do, what they make, and how preservation efforts can respond to the situated meaning of artifacts, build on my tri-partite methodology for conducting this study. To address the archival challenge, we must:

- Understand the historical trajectory of the development of artifacts in the practice we seek to document;
- Reflect on the assumptions we bring into appraisal decisions;
- Actively engage creators and users in decision-making.

What stories do we want to tell about a project, a firm, an architect, the built environment, and who is making the appraisal decisions? At the point of making decisions, what kinds of questions should we ask? What will make sense in practice – how will it be different across practices, across different individuals? In my socio-technical approach to examining how to best document architectural practice, to address the value of artifacts within the complex social context in which they are created, shared, preserved and

discarded, I asked these questions in the Introduction and again in Chapter 3 to describe my research design:

What is the role of artifacts in architectural practice? How do artifacts figure into decision-making processes?

I found that there are multiple roles of artifacts in practice. As described, artifacts are active agents and serve to communicate intention and expertise. Artifacts enable decision making as well as document decisions made. As such, they serve as evidence and as traces of the everyday activities in architectural work.

What are the processes that lead to artifact creation, destruction, and preservation?

Artifacts are created in the process of designing a building, sharing information about a project, and communicating an idea or changes. Artifact destruction can be intentional for business and legal purposes, but it can also be the result of renovating the office, a server crash, moving to a new workstation, or a person's retirement. The preservation of artifacts depends on what is easy and what makes sense in the moment.

What do artifacts reveal about architecture?

Artifacts reveal how much of architectural work is negotiation between many participants – other designers, clients, consultants, contractors, lenders, insurance companies, municipalities, code-makers. The amount of documentation of work done in architecture is substantial, as we saw in the description of the filed emails regarding one project, and

takes many forms. These artifacts can reveal how architects coordinate complex work, including work by other people across multiple domains, as well as managing vast amounts of information. Artifacts can reveal what architects do and what they make, at times even how they make decisions. The artifacts document an instance within an architectural information system and provide insight into the building culture, by demonstrating the range of participants involved in one single building project.

Who makes judgments about which artifacts to keep in everyday practice?

The simple answer is everyone. The complex answer is also everyone. In everyday architectural practice, individuals make decisions about which artifacts have value. At times these decisions are deliberate, such as choosing to discard rolls of drawings that have occupied space in one's office during a renovation project, or deciding that a particular email is significant enough to transfer it to Newforma as project documentation. Much of the time, decisions are tied to expectations about what must legally be kept for a given length of time. But there is also a pervasive perception, at least in the firm I visited, that digital files are increasingly kept because it is easier than choosing to delete. This question could be expanded to consider who makes firm-wide decisions about the technical infrastructure to support maintaining these digital files. It is also worth noting that everyone is responsible for making decisions about what to keep and equally responsible for decisions that determine how accessible these files may be in the future, in terms of how they name and organize files. Maintaining versions of particular software may fall outside

the purview of any given architect in the firm, but decisions are made that will have implications for being able to access artifacts.

Which material artifacts produced in architectural practice have enduring value for documenting the built and unbuilt environment and interpreting the culture of the communities in which they are created?

Ideally we would be platform-, system-, and technology-agnostic – just as collecting archives may have been about what type of pencils, pens used, paper, and reproduction processes were used. But the complexity of the artifacts created requires attention if we want to capture dynamic files that are software dependent. In some cases, the version of the software in which the artifact was created will be necessary to access files. Firms may not retain versions they used beyond a few years. We must begin to work on archiving the software, as well as understanding the contexts in which they were created. Understanding the firm, its organizational structure, and project team structures, can help make sense of the files generated and the relationship between artifacts, which will be useful for describing these artifacts in meaningful and accurate ways.

PRIMARY CHALLENGES

So, what are the primary challenges in preserving architectural artifacts, based on what I saw in practice and what I have learned about architectural technology? There are three key themes I identified as major challenges, emerging from what I heard in the firm and my knowledge of the technology. These challenges can be addressed at an individual

firm level, but there would be a great benefit to collaborating with others across the industry and from records management and preservation fields to identify preservation practices that could become part of a sustainable information infrastructure, built upon the existing architectural information system. The three challenges are identified below.

Proliferation of data, files, iterations of artifacts regarding architectural projects

Given the range of actors involved in the design and construction of architectural projects and the iterative nature of design, it should be no surprise that numerous artifacts are created and shared. Making decisions about which artifacts have value is necessary for both the management of these records and for making what is kept meaningful and intelligible. But these appraisal activities are time consuming and rely on having systems in place to organize artifacts for preservation and access.

Organization of artifacts in firms

In my study, I found that there are varied practices and file-naming standards applied within one firm. Informants spoke to their knowledge of other firms with rigorous standards and identified the benefits and drawbacks of prescribed methods for organizing their work. File structures that persist despite technology changes felt inadequate for current practice, yet consistent metadata is needed to make files intelligible over time.

Multiple versions of proprietary software programs

Archivists need to actively work to preserve the software, and the associated hardware, as well as the artifacts created using that software and to maintain connections between the software version and the file. There are efforts, such as the Software Preservation Network, to address the challenges of accessing digital objects. Engagement with information professionals who are working across domains to preserve software, including architecture-specific technologies, is highly recommended as a strategic way to work toward collecting and preserving artifacts of the architectural information system.

CONCLUSION

In Chapter 6, I identified descriptors for practice, drawing from what I learned through three research methods. I returned to themes described in Chapter 2 and provided examples of how these themes are evident in everyday practice. I addressed how my research specifically addresses the specific research questions I sought to answer. Additionally, I assert what I see as the primary archival challenges and what I think we must do to address these challenges. In the final chapter, I conclude by demonstrating what we learned and outlining a role for archivists in the architectural information system and in building culture.

Chapter 7: Conclusion

The goal of the study described here was to consider how to best document architectural practice. Instead of trying to preserve digital versions of records that archives typically keep, I want us to examine what artifacts are made and how and why they are made, to ask which artifacts should become records, how preservation efforts can respond to the situated meaning of artifacts, and who else is part of the architectural information system. My research involves a situated socio-technical examination of the culture of architecture, wherein actors make decisions and negotiations every day that affect artifact creation, management, and preservation. Decisions about what to keep have political consequences within building culture. My argument is that all participants in architectural practice are making archival decisions when they actively select what to make, what to discard, and what to keep. The narrative structure of my dissertation provides a framework for addressing the central research question by allowing me to articulate how my thinking shifted as I wrote about writing, drew images of drawing in action, and continually reflected on my interpretations. Each of my methods represents particular assumptions I bring to my interpretation of architectural practice. Framed as a narrative, I could share these assumptions and reveal my own practice of making value determinations.

Archivists, in making appraisal decisions, actively participate in the architectural information system, selecting which documentation will be used in crafting narratives about building culture. Artifacts can serve as traces – fragments that help humanities scholars construct an interpretation of phenomena, such as the history of a particular

building's design, or they can help social scientists make a type of work visible, such as coordination across a geographically dispersed project team. Collections of artifacts can illuminate how decisions were made over time, how people organized their work, and how professions change, evolve, and implement new technologies. They can also demonstrate and inspire innovations. How we choose to keep artifacts and make them accessible has implications for the way we understand culture and construct it.

One way to approach how to best document architectural practice is to consider how to construct a meaningful set of artifacts. How do we define meaningful? Who is the authority in making these appraisal decisions? If we apply a continuum approach to archival appraisal, how can we acknowledge the multiple, and shifting, meaning of artifacts while still making decisions? Recall the meeting I described in the introduction:

> I had the benefit of being at such a table, on the archivist side, during a meeting about the potential transfer of records from a firm to an archives. The head archivist asked the architects which materials should be donated to best document the firm and represent its legacy. The architects responded that the archivists should make that determination. Each group was working from the assumption that the other had the expertise to make determinations about the value of architectural records. My argument is that they are both correct. These two different groups of actors have roles in actively selecting which artifacts become records. Architects make decisions about the enduring value of artifacts in the doing of architecture while archivists make value judgments in the appraisal of architectural records transferred to the archives.

Effective context-specific appraisal requires deliberate decision-making by architects and archivists in conversation with one another. Each group has expertise that is necessary to address the complexity of the problem, and by collaborating they can acknowledge the messiness of practice but make that mess itself intelligible. Archivists can help architects be less ad hoc in decision-making with regard to the artifacts of their work. Architects can

help archivists document the ad hoc, in order to make the messiness of practice more intelligible in the ways we describe the artifacts of practice. Architects, as coordinators of complex projects, demonstrate their expertise in managing information about projects. Archivists bring their appraisal expertise into negotiations about the value of artifacts and serve as bridges to other communities of users, which is important to address the changing value of artifacts over time and for different audiences. An open exchange of ideas about an architectural information system, that extends beyond architects and archivists, is one step we can take toward Howard Davis' "healthy building culture," a concept I explore in the final pages of this dissertation.

FRAMES, IMPLICATIONS, AND LIMITATIONS

My research begins from the assumption that architectural artifacts have value. They are sources of information that document the built (and unbuilt) environment and the social history of the communities in which they are created. I approached this study to understand how architectural artifacts are made and what they can tell us about the practice of architecture. Ontologically, as constructionists, interpretivists are looking "for culturally derived and historically situated interpretations of the social life-world" (Crotty, 1998, 67). Researchers document these interpretations as representations of reality, but understand that the meaning is co-created in the social encounter, and is not universal. Epistemologically, interpretivists are working under the assumption that knowledge is socially constructed, so studying context and individual interpretations within a context, are ways of making meaning about a phenomenon. Methodologically, interpretivists often

employ historical research, ethnography, life histories, or case studies to explore a particular context or phenomenon. My tri-partite methods are all informed by my ontological, epistemological, methodological assumptions, which serve as the foundation for my iterative and interpretive research process.

Understanding the activities we want to document is the first challenge. My initial intent was to explore what records were created in an architectural practice, which digital technologies were used, and what hardware, software, and workflows are needed to preserve architectural records. My thinking evolved in the course of my doctoral studies. The first major shift took place once I engaged architects at the firm in conversation and observed their interactions. I came to realize that artifacts of practice document not just the buildings but also negotiated processes of decision-making that are inherently social. Reflecting on evidence of design changes I had seen on drawings in my experience processing records, I realized my early (and naïve) assumptions or acknowledged guesses about who drew specific drawings were predicated on limited information about a firm that typically focused on a single creator. I approached the dissertation study as a way of trying to address the disparity between the way architecture is typically represented, between the stories I heard about how architecture is done, and what I saw in practice, which made me question the myth of the solo architect. I wanted to understand more fully the complexity of practice that was evident to me from my pilot study.

As I began studying architecture and the creation of artifacts, I learned that the activities I was interested in changed over time, the tools used also changed over time, and, in many ways, the practice of architecture was changing over time. Given my background

as an architectural historian and my concern for the continuity of architectural documentation, I began investigating the history of technology developed for architecture. In Chapter 4, I presented one interpretation of that history, by identifying specific cases involving changes in technology that have implications for the industry. My choices were based on the readings presented here, my pilot study, and my own experiences as an archivist and architectural history student within a School of Architecture. I have contributed my interpretation of the history to this dissertation as well as publishing it as "Technology in Architectural Practice: Transforming Work with Information, 1960s–1990s" in *Information and Culture* (Spring 2016).

I conducted an in-depth case study that provides an enhanced understanding of what contemporary architectural practice looks like and how artifacts are an integral part of the doing of architecture. Chapter 5 functions as an intervention into an architectural workplace and an act of engaging architects in conversation about what they make, how they organize their work, what they value, and where frustrations exist in recordkeeping practices. Chapter 5 reveals that preservation and digital asset management, while not the focus of their work, resonates with these practitioners, who understand the implications of data loss for their own work and, by extension, for the cultural record. Constructing a narrative account let me demonstrate how each method is part of a layered approach to understanding the complexity I am seeking to address.

One limitation of my study is that my engagement focused on a single large architecture firm. While I cannot address specific characteristics of other contexts or compare what I saw in this practice to other situated contexts, I contribute this study to the

"collective process of knowledge accumulation" on architectural practice and the resulting artifacts of practice (Flyvbjerg 2006, 227). Flyvbjerg describes selection and identification of cases, giving four types that are "information-oriented" as opposed to random. "Information-oriented" selections are chosen to allow for the "greatest possible amount of information on a given problem or phenomena" (Flyvbjerg 2006, 229). "Extreme or deviant cases" seek information on unusual cases. "Maximum variation cases" are designed to investigate a phenomenon across multiple cases that differ in a specific way, such as size or location. A "critical case" makes a strategic choice of a case that may allow for generalizations beyond the local case. "Paradigmatic cases" are designed around cultural paradigms, seeking to provide an exemplar or set a standard for a given domain. In my selection of Jackson Architects, I acknowledge that I did not seek to compare practices across multiple firms or identify a firm with a reputation for advanced technology implementation. I did, however, choose a large firm with a history of archival documentation and an openness to investigation. If we can document recordkeeping challenges present in this environment, this knowledge has value for other cases. My study is one of many cases that need to be examined within building culture. Exploring the work practices and artifacts created by other project teams or in a different firm will add to the rich stories about how architects communicate and coordinate their work. Comparing work practices at this large firm with that of architects in a small boutique firm might reveal very different modes of work and actors in everyday practice, which may have implications for the artifacts of the practice. Prior access to the firm in my pilot study allowed me to understand specific changes in the industry over time through the lens of practice at the

one firm. I benefitted from being present as the firm was implementing a shift to using Revit for architectural design, which led me to focus on engagement with that specific software, in my historical and reflective analyses.

While my focus on AutoCAD and Revit was informed by the specific choices made at the Jackson Architects as well as extensive coverage in architectural publications, there are numerous other software programs that should be examined in the historical trajectory of software development for architecture. The story I tell here is intentionally limited to focus on specific tools. Additional research should explore other software programs in different situated contexts to further contribute to a broad understanding of software in the architectural information system. Additionally, I also focused on AutoDesk's role in increasing collaborative work, addressing the economic motivation of the company only through description of marketing practices. AutoDesk has been an enabler, seducer, and partner in the shift to the widespread use of computer technology for architectural practice. The company could still play these roles in the preservation of the artifacts they helped create, further contributing to the architectural information system.

ARCHITECTURAL INFORMATION SYSTEM

In this dissertation, I have introduced "architectural information system" as a concept to define the network of people and artifacts in architectural practice. Professional organizations, educational institutions, industry publications, informal communication among colleagues – these all play a role in an architectural information system, wherein values are constructed, shared, revised, re-enforced, and challenged. My argument here is

that archivists have a role to play in the system, specifically in helping to build the architectural information infrastructure for long-term story-telling about architecture.

I now know that this study is simply the beginning – a start at telling an architectural history that considers the multiple actors engaged in everyday practice. I have also embraced the idea that the concerns that initially motivated my research – long-term preservation of architectural records – will continually evolve as the practices, technologies, and artifacts continue to evolve, and that archivists and architects must learn to embrace and make the most of that volatility.

BUILDING CULTURE

Howard Davis' notion of "building culture" addresses how a society builds. A "building culture" is comprised of people, technologies, codes, rules, behaviors, habits, techniques, and I add – artifacts that can illuminate all of these things. "Building culture" as concept is based on an historical extension of specific gradual changes in the ways that buildings are constructed and that practitioners exchange information. In this dissertation, I have demonstrated how artifacts are active participants in building culture. Archivists have an important role to play in building culture, as decisions about which artifacts of practice are preserved and how these artifacts are described and made accessible are all part of the ongoing building of culture. Artifacts provide documentation to tell stories about the how a society chooses to make, deconstruct, and remake the built environment.

Davis describes a "healthy building culture" in many ways, but one of the key factors involves "shared knowledge" wherein "knowledge is shared among many people,

inside and outside of building culture, and there is a common understanding of buildings and the way they are built" (Davis 1999, 14-15). The importance of sharing knowledge does not de-value the expertise of any particular group, but instead, benefits from a diversity of perspectives and domains of knowledge. Given the large-scale challenges of documenting practice and preserving complex digital objects created in contemporary design, along with the potential to harness the insight and expertise of a range of participants, the upcoming symposia I mentioned in Chapter 1 are attempts to do just that – share information, build community, and work toward an infrastructure for archiving architectural artifacts. We must be cautious and remember that actions we take not only determine which artifacts we keep and which stories can be told, but that these documentary efforts contribute to the continual creation of culture. Who participates will have implications for how value is determined.

DIRECTIONS FOR FURTHER RESEARCH

I will bring my research into conversation with archivists, architects, and others seeking to address the challenges of managing and preserving architectural artifacts. An initial step toward this sustained engagement is my involvement on the program committee for a summit on digital assets: *Designing the Future Landscape: Digital Architecture, Design and Engineering Assets*, a program organized by the Library of Congress, the Architect of the Capitol, and the National Gallery of Art.

We must participate in and organize these conversations, at national and international scales, as well as in small-scale interventions, such as my own described here.

The accumulation of cases that examine how artifacts are created and used in practice will be necessary for continuing to address preservation challenges. It is also necessary to develop more use cases for architectural records, particularly digital artifacts. Archivists and historians are particularly well-suited to address the questions of what information we want to be able to access, although we shouldn't discount the value of architectural records to other researchers. Records documenting the built environment contribute to the stories we can tell about society and about the choices that are made everyday about gets built (or not built), what to preserve (or demolish), and who has (or lacks) agency in the decision-making.

Another area of future research is the education of architects, particularly how contemporary architectural education does or does not address the management of digital design data. Bringing personal and architectural information management as well as an understanding of the long-term implications for cultural heritage into conversation could contribute to our understanding of the ways in which we are continually creating culture. Engaging future generations of architects in knowingly and critically managing their digital design assets can enable us to construct an effective information infrastructure for the built environment. We should examine how students could develop an understanding, "learned as part of their membership," of the artifacts of their own practice as related to and part of an architectural infrastructure of material artifacts (Star 1999, 381).

Methodologically, this dissertation brought together a humanities approach by examining the history of sociological study and the history of computing for architecture. I looked deeply at the artifacts of practice and brought my own perspective as a historian

and archivist to my work. Through my research, I also worked as a social scientist, immersing myself in the tools and focusing on the interactions of people and artifacts. I learned how to do this type of study and saw how work was done differently over time. I also engaged how my perception of what I saw, read, and learned was different over time as well, as I evolved as a researcher and practitioner. This deep, sustained engagement with how to document architectural practice is a contribution to how we should develop an infrastructure for architectural information.

TOWARD AN INFRASTRUCTURE FOR DOCUMENTING ARCHITECTURAL PRACTICE

I focused on architectural practice in the United States from the 1960s onward, because the introduction of computer technologies into everyday architectural practice has significant implications for the types of artifacts that are created and for the challenges associated with preserving these artifacts. Additionally, I examined how and why architects create artifacts and decide to keep some artifacts and discard others, and examined that decision-making in practice. Recall my overarching research question:

> *How might architectural artifacts be preserved in ways that illuminate the complexity of practice and the multiple layers of assumptions and values that inform the co-construction of the built environment?*

I began from an assumption that architecture is complex, collaborative, and messy. Based on my pilot study, research on the sociology of practice, and my own archival work, I started this project with a concern for the multiple perspectives that are present in everyday practice. We will still get collections as an afterthought, as they are on the way to the trash. We will still encounter the limited, de-contextualized fragments of

documentation. And we will persist in trying to make these records accessible and meaningful. This study presents a context for understanding how architectural artifacts are made and the complexity of the environment in which decisions are made about what has value. To the extent that we can, we should acknowledge our roles in making meaning – in making selections, recommendations, and finding aids, in setting priorities for what we collect and how we provide access to materials. We should also actively participate in conversations about how to manage, describe, and ascribe value in architectural practice. As identified by the architects I spoke with, in everyday practice, people will do what is easy. How do we work within the architectural information system to make preserving architectural artifacts in meaningful ways the easier solution?

As firms grapple with concerns about managing their own digital design data, archival expertise can be valuable to conversations about what constitutes best practice for everyday work as well as long-term preservation. We now know that, by engaging architects in conversation about their work practices, we can identify individual and firm-level frustrations with organizing, finding, and maintaining files. We know that architects are concerned with the preservation of their digital design data and that their own access can be limited by the availability of the specific version of proprietary software. We know that, in this particular case, a BIM manager was a new type of coordinating role that was developed within a project team. While there are multiple ways to interpret this change, I can argue that it is an important designation in a project team, as it notes a need for a centralized role to coordinate work with outside consultants who access the Revit file, but with less frequency than project team members. The BIM manager controls access to the

BIM, serving as a gatekeeper to the information contained in the model. She also takes on additional responsibility for communicating changes effectively, both within and outside the project team.

We know that studying complex work practices can be done in different ways. I have studied the history of technology development as a means to provide a broad context for understanding how we came to be in this position – how archivists must now confront complex digital objects in attempting to document architectural practice. These complex digital objects, such as AutoCAD or Revit files (among others) are not wholly new technological developments, but these formats have a historical trajectory that can be linked to the ways architects work and to the social context in which they work. By understanding the historical trajectory and the ways contemporary architects work, I assert that documenting architectural practice can be understood differently – not as discrete collections of records that document the work of solo architects or firms, but as artifacts within an architectural information system. Now we must build the social and technical infrastructure to facilitate ongoing preservation and access.

The infrastructure for archiving digital documentation should build upon and critically examine what I have described as an existing architectural information system. Documenting architectural practice will require an extensive collaborative network of people to create systems for long-term preservation and access to records. Following my pilot study, I argued that it is necessary to build a "network of collaborators that will include librarians, archivists, museum professionals, architectural firm employees, and technology

preservation scholars."[9] To this list, I now add record users (architectural historians, property owners, historic preservationists, to name a few) and software creators and vendors. Additionally, there is value in working with people in other fields who create and preserve complex digital objects, from related CAD/CAM artifacts of aerospace engineering to the records of video game designers.

One of the great challenges is that these different groups, and individuals within them, will come with different perspectives and different priorities. Bridging the disconnect between contemporary practice and the ability to preserve architectural records requires that the conversation between these disparate fields continue. My dissertation research is a contribution to the conversation, based on my assumption that knowledge of the history of technologies for architecture and insight into the everyday doing of architecture can help us decide how to address archival questions about the volume, duplication, dispersion, impermanence, and technology-dependence of artifacts.

[9] In "Collaborative Efforts to Preserve Born-Digital Architectural Records: A Case Study Documenting Present-Day Practice." *Art Documentation* 30:2 (Fall 2011): 43-48.

Appendix A: Pilot Study Institutional Review Board Letter

OFFICE OF RESEARCH SUPPORT

THE UNIVERSITY OF TEXAS AT AUSTIN

P.O. Box 7426, Austin, Texas 78713 (512) 471-8871 -FAX (512 471-8873)
North Office Building A, Suite 5.200 (Mail code A3200)

FWA # 00002030

Date: **06/11/10**

PI(s): **Kathryn A Pierce**
Philip Doty

Department & Mail Code: **UNIV OF TX LIBS-ARCH/PLAN LI S5430**
SCHOOL OF INFORMATION D8600

Title: **Documenting Architectural Practice: An Introductory Investigation of Digital Project Records**

IRB EXEMPT DETERMINATION – IRB Protocol # **2010-03-0003**

Dear: **Kathryn A Pierce**

Recognition of Exempt status based on 45CFR 46.101(b).
Qualifying Period: 06/11/2010 - 06/10/2013 *Expires 12 a.m. [midnight] of this date.*
A continuing review will need to be submitted in three years if the research is still pending.

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Responsibilities of the Principal Investigator(s):

Research that is determined to be Exempt from IRB review is not exempt from protection of the human subjects. The following criteria to protect human subjects must be met:

1. The Principal Investigator assures that all investigators and co-investigators are trained in the ethical principles, relevant Federal Regulations and institutional policies governing human subject research.

2. The Principal Investigator assures that human subjects will voluntarily consent to participate in the research when appropriate (e.g. surveys, interviews) and will provide subjects with pertinent information (e.g. risks and benefits, contact information for investigators and IRB Chair).

3. The Principal Investigator assures that human subjects will be selected equitably, so that the risks and benefits of the research are justly distributed.

4. The Principal Investigator assures that the IRB will be immediately informed of any information or unanticipated problems that would increase the risk to the human subjects and cause the category of review to be upgraded to Expedited or Full Review.

5. The Principal Investigator assures that the IRB will be immediately informed of any complaints from participants regarding their risks and benefits;

6. The Principal Investigator assures that confidentiality and privacy of the subjects and the research data will be maintained appropriately to ensure minimal risk to subjects; and

7. The Principal Investigator will report, by amendment, any changes in the research study.

These criteria are specified in the PI Assurance Statement that must be signed before determination of Exempt status will be granted. The Responsible Investigator's signature acknowledges that he/she understands and accepts these conditions. Investigators can refer to the Office of Research Support (ORS) website, www.utexas.edu/irb for specific information on training, voluntary informed consent, privacy, and how to notify the IRB of unanticipated problems.

1. **Closure:** Upon completion of the research project, a closure request must be submitted to the ORS.

2. **Unanticipated Problems:** Any unanticipated problems or complaints must be reported to the IRB/ORS immediately. For a description of unanticipated problems, please refer to the ORS webpage: http://www.utexas.edu/research/rsc/humansubjects/policies/section7.html#7.3

3. **Informed Consent:** The informed consent procedures laid out within your research proposal must be followed.

4. **Continuing Review:** If the study will continue beyond the three year approval period, a continuing review application must be filed.

5. **Amendments:** Amendments do not need to be filed with the ORS if the amendments do not change the risk level of the study (for example: increasing sample size, adding or removing co-PIs, adding or removing research sites, or minor modifications to the research protocol). Changes altering the level of risk to participants must be requested by submitting an amendment application and revised proposal to the ORS prior to those changes being implemented. For a description of the types of modifications that require an amendment application, refer to the ORS webpage: http://www.utexas.edu/research/rsc/humansubjects/policies/section6.html#635b , or call 471-8871.

Sincerely,

Jody L. Jensen, Ph.D.
Professor
Chair, Institutional Review Board

Appendix B: Institutional Review Board Letter

OFFICE OF RESEARCH SUPPORT

THE UNIVERSITY OF TEXAS AT AUSTIN

P.O. Box 7426, Austin, Texas 78713 · Mail Code A3200
(512) 471-8871 · FAX (512) 471-8873

FWA # 00002030

Date: 06/30/16
PI: Philip Doty
Dept: Information, School of
Title: Documenting Architectural Practice: A Socio-Technical Examination

Re: IRB Exempt Determination for Protocol Number 2016-06-0027

Dear Philip Doty:

Recognition of Exempt status based on 45 CFR 46.101(b)(2).

Qualifying Period: 06/29/2016 to 06/28/2019. *Expires 12 a.m. [midnight] of this date.*
A continuing review report must be submitted in three years if the research is ongoing.

Responsibilities of the Principal Investigator:

Research that is determined to be Exempt from Institutional Review Board (IRB) review is not exempt from ensuring protection of human subjects. The Principal Investigator (PI) is responsible for the following throughout the conduct of the research study:

1. Assuring that all investigators and co-principal investigators are trained in the ethical principles, relevant federal regulations, and institutional policies governing human subject research.
2. Disclosing to the subjects that the activities involve research and that participation is voluntary during the informed consent process.
3. Providing subjects with pertinent information (e.g., risks and benefits, contact information for investigators and ORS) and ensuring that human subjects will voluntarily consent to participate in the research when appropriate (e.g., surveys, interviews).
4. Assuring the subjects will be selected equitably, so that the risks and benefits of the research are justly distributed.
5. Assuring that the IRB will be immediately informed of any information or unanticipated problems that may increase the risk to the subjects and cause the category of review to be reclassified to expedited or full board review.

6. Assuring that the IRB will be immediately informed of any complaints from subjects regarding their risks and benefits.

7. Assuring that the privacy of the subjects and the confidentiality of the research data will be maintained appropriately to ensure minimal risks to subjects.

8. Reporting, by submission of an amendment request, any changes in the research study that alter the level of risk to subjects.

These criteria are specified in the PI Assurance Statement that was signed before determination of exempt status was granted. The PI's signature acknowledges that they understand and accept these conditions. Refer to the Office of Research Support (ORS) website www.utexas.edu/irb for specific information on training, voluntary informed consent, privacy, and how to notify the IRB of unanticipated problems.

1. Closure: Upon completion of the research study, a Closure Report must be submitted to the ORS.

2. Unanticipated Problems: Any unanticipated problems or complaints must be reported to the IRB/ORS immediately. Further information concerning unanticipated problems can be found in the IRB Policies and Procedure Manual.

3. Continuing Review: A Continuing Review Report must be submitted if the study will continue beyond the three year qualifying period.

4. Amendments: Modifications that affect the exempt category or the criteria for exempt determination must be submitted as an amendment. Investigators are strongly encouraged to contact the IRB Program Coordinator(s) to describe any changes prior to submitting an amendment. The IRB Program Coordinator(s) can help investigators determine if a formal amendment is necessary or if the modification does not require a formal amendment process.

If you have any questions contact the ORS by phone at (512) 471-8871 or via e-mail at orsc@uts.cc.utexas.edu.

Sincerely,

James P. Wilson

James Wilson, Ph.D.
Institutional Review Board Chair

Appendix C: Interview Schedule

1. I began with questions about work responsibilities to get the respondent talking about their role in the firm.

    - Tell me about your work here.
    - How long have you been with firm?
    - Has your position/role changed over time?

2. Next, I posed questions about interactions with other people in their work.

    - Do you work with others on a regular basis? Who?
    - When do you work alone? When do you work with others?
    - Do you interact with others outside the firm in your work? Who? What is the nature of these interactions?
    - How do you communicate with others when working in a project?

3. Then I asked about tools and technologies to begin to follow the artifacts of practice.

    - What methods do you use for creating documents – pen/pencil, computer software?
    - Which programs do you use?
    - How do you share information with others - within the firm/outside the firm?
    - Do you, individually, have an organization system for documents? What do you save regularly? What do you discard?
    - How are documents saved in the firm? What is the process for documenting your work on a project? What about documenting a project?
    - Do you use artifacts in your work? Do you need access to older documents? How do you access those?
    - Have you ever had trouble finding needed documentation? Why?

4. Finally, I addressed decision making practices within the firm.

    - What kinds of decisions are made in your work? How are decisions made and who is involved? Do artifacts (drawings, other document) figure into decision-making process?
    - Who communicates information about decisions to the firm and those outside the firm?
    - Who decides how project documentation is managed?
    - What determines whether something is kept or discarded?

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Vita

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